

790. Willow flycatcher and yellow warbler response to cattle grazing.

Taylor, D. M. and Littlefield, C. D.
American Birds 40(5): 1169-1173. (1986)
NAL Call #: QL671.A32; ISSN: 0004-7686
Descriptors: Empidonax traillii/ Dendroica petechia/ human activity/ habitat protection
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Plant Ecology, Biodiversity, and Other Environmental Effects

791. 14 vs. 42-paddock rotational grazing aboveground biomass dynamics forage production and harvest efficiency.

Heitschmidt, R. K.; Dowhower, S. L.; and Walker, J. W.
Journal of Range Management 40(3): 216-223. (1987)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1987/403/6heit.pdf>
Descriptors: cattle/ Texas/ USA/ stocking densities/ growing season
Abstract: Research was initiated at the Texas Experimental Ranch in 1981 to quantify the effects of 2 stocking densities, equivalent to 14- and 42-paddock rotational grazing (RG) treatments, on aboveground biomass dynamics, aboveground net primary production (ANPP), and harvest efficiency of forage. Baseline data were collected in 1981 from 3 adjacent 30-ha paddocks in a 14-paddock, cell designed RG treatment. Near the beginning of the 1982 growing season the center paddock was subdivided into three, 10-ha paddocks to establish the RG-42 treatment. Stocking densities in the 14- and 42-paddock treatments were 4.2 and 12.5 AU/ha, respectively, from March 1982 to June 1984 and 3.0 and 9.1 AU/ha from June to November 1984. During 1981, estimated ANPP in the two RG-14 paddocks averaged 4,088 kg/ha as compared to 5,762 in the single RG-42 paddock. Following subdivision, ANPP in the RG-14 paddocks averaged 2,533 kg/ha as compared to 2,670 kg/ha in the RG-42 paddocks. Although ANPP varied significantly among the 4 years of the study it was not affected by density treatment. Likewise, harvest efficiency varied among years but was unaffected by density treatment. Average harvest efficiency over the 4 years was about 42%. Aboveground biomass dynamics were also generally unaffected by density treatments.
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792. Alfalfa survival and vigor in rangeland grazed by sheep.

Berdahl, J. D.; Wilton, A. C.; Lorenz, R. J.; and Frank, A. B.
Journal of Range Management 39(1): 59-62. (1986)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1986/391/15berd.pdf>
Descriptors: Medicago/ cultivars/ germplasm/ grazing/ regrowth/ sheep/ rangelands/ North Dakota
This citation is from AGRICOLA.

793. An assessment of restoration of biodiversity in degraded high mountain grazing lands in northern Ethiopia.

Asefa, D. T.; Oba, G.; Weladji, R. B.; and Colman, J. E.
Land Degradation and Development 14(1): 25-38. (2003)
NAL Call #: S622.L26; ISSN: 1085-3278
Descriptors: state and transition model: mathematical and computer techniques/ biodiversity restoration/ land

abandonment/ land degradation/ mountain grazing lands: area enclosures, open management schemes/ soil properties/ species richness/ vegetation composition

Abstract: Loss of biodiversity is the single most important threat to the conservation and sustainable use of drylands in northern Ethiopia due to many centuries of cultivation and heavy livestock grazing pressure. The current study assessed the restoration of biodiversity in highly degraded areas in eastern Tigray, northern Ethiopia using area enclosures (AEs). The study assessed whether the differences in biodiversity between AEs and open management schemes and time of land abandonment influenced diversity of plant life forms (i.e. herbs, shrubs and trees). Changes in biodiversity were compared using the state-and-transition model. Management types and time since abandonment (hereafter called age) had a significant effect on herbaceous plant species abundance but not in shrub species, while site factors had a greater effect on diversity of plant life forms in general. Herbaceous species richness increased with age of restoration, reaching a maximum after three years of rest and declined thereafter, most probably as a result of hay harvesting and replacement of annual species by perennial grass species. Tree species richness increased gradually with age of land abandonment up to the maximum age of eight years. Four vegetation states and seven possible transitions that could guide management were identified. The vegetation states differed in terms of diversity of herbs and tree species but not those of shrubs. Promotion of tree species states will require longer periods of rest, while promotion of herbaceous species richness will need shorter periods. The state-and-transitional model could, therefore, be used to guide future management by promoting vegetation states that are desired by land users.
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794. Bacteria as bioindicators in wetlands:

Bioassessment in the Bonneville Basin of Utah, USA.
Merkley, M.; Rader, R. B.; McArthur, J. V.; and Eggett, D.
Wetlands 24(3): 600-607. (2004)
NAL Call #: QH75.A1W47; ISSN: 0277-5212
Descriptors: marshes/ wetlands/ basins/ biodegradation/ genetic analysis/ indicator species/ grazing/ surface area/ comparative studies/ analytical techniques/ genetics/ bioassays/ degradation/ man-induced effects/ anthropogenic factors/ genetic diversity/ species diversity/ bacterial/ biodiversity/ organic compounds/ substrates/ ecosystems/ bioindicators/ USA, Utah, Bonneville Basin
Abstract: Bacteria should be excellent indicators of the early signs of degradation caused by human intervention because they have the highest surface area to volume ratio of all organisms. We determined the utility of a simple procedure that measures aerobic bacterial metabolic

diversity (BIOLOG EcoPlates) as a reliable tool for assessing the effects of cattle grazing on spring ecosystems of the Bonneville Basin, Utah, USA. Marshes disturbed by cattle could be distinguished from protected marshes using EcoPlate analyses. The diversity of organic compounds used by bacteria was greater in grazed versus ungrazed marshes. A separate genetic analysis (DGGE) provided corroborating evidence. Greater metabolic diversity (EcoPlates) corresponded to greater bacterial assemblage diversity in grazed versus protected marshes. Greater plant diversity at grazed sites might account for the greater diversity of organic substrates used by bacteria in grazed sites. However, the results were not conclusive. In some marshes, a greater diversity of organic substrate use occurred where there was greater plant diversity, whereas in other marshes the diversity of organic substrates used by bacteria was lower where plant diversity was greatest. Regardless of the mechanism, aerobic bacterial metabolic diversity (EcoPlates) is a potentially valuable tool for assessing the early signs of degradation in wetland ecosystems.

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795. Below-ground biomass and productivity of a grazed site and a neighbouring ungrazed enclosure in a grassland in central Argentina.

Pucheta, Eduardo; Bonamici, Ivano; Cabido, Marcelo; and Diaz, Sandra

Austral Ecology 29(2): 201-208. (2004)

NAL Call #: QH540 .A8; ISSN: 1442-9985

Descriptors: long term enclosure: applied and field techniques/ below ground biomass/ below ground net plant productivity [bnpp]/ climates/ grazing impact/ mountain grasslands/ root turnover rates/ seasonal variation

Abstract: We estimated the below-ground net plant productivity (BNPP) of different biomass components in an intensively and continuously 45-ha grazed site and in a neighbouring enclosure ungrazed for 16 years for a natural mountain grassland in central Argentina. We measured approximately twice as much dead below-ground biomass in the grazed site as in the ungrazed site, with a strong concentration of total below-ground biomass towards the upper 10 cm of the soil layer in both sites. The main contribution to total live biomass was accounted for by very fine (<0.5 mm) and fine roots (0.5-1.0 mm) both at the grazed (79%) and at the ungrazed (81%) sites. We measured more dead biomass for almost all root components, more live biomass of rhizomes, tap roots and bulbs, and less live biomass of thicker roots (>1 mm) in the grazed site. The seasonal variation of total live below-ground biomass mainly reflected climate, with the growing season being limited to the warmer and wetter portion of the year, but such variation was higher in the grazed site. Using different methods of estimation of BNPP, we estimated maximum values of 1241 and 723 g m⁻² year⁻¹ for the grazed and ungrazed sites, respectively. We estimated that very fine root productivity was almost twice as high at the grazed site as at the ungrazed one, despite the fact that both sites had similar total live biomass, and root turnover rate was twofold at the grazed site.

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796. Benefits of protective fencing to plant and rodent communities of the Western Mojave Desert, California.

Brooks, Matthew L.

Environmental Management 19(1): 65-74. (1995)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: alien grass/ annual plant biomass/ community diversity/ desert ecosystem/ desert tortoise research natural area/ forb biomass/ human disturbance/ Kern County/ livestock grazing/ Merriami's kangaroo rat/ method/ protective effect

Abstract: Human disturbance in the western Mojave Desert takes many forms. The most pervasive are livestock grazing and off-highway vehicle use. Over the past few decades several areas within this region have been fenced to preclude human disturbance. These areas provide opportunities to study the impact of human activities in a desert ecosystem. This paper documents the response of plant and small mammal populations to fencing constructed between 1978 and 1979 at the Desert Tortoise Research Natural Area, Kern County, California. Aboveground live annual plant biomass was generally greater inside than outside the fenced plots during April 1990, 1991, and 1992. The alien grass *Schismus barbatus* was a notable exception, producing more biomass in the unprotected area. Forb biomass was greater than that of alien annual grasses inside the fence during all three years of the study. Outside the fence, forb biomass was significantly higher than that of alien grasses only during spring 1992. Percent cover of perennial shrubs was higher inside the fence than outside, while no significant trend was detected in density. There was also more seed biomass inside the fence; this may have contributed to the greater diversity and density of Merriam's kangaroo rats (*Dipodomys merriami*), long-tailed pocket mice (*Chaetodipus formosus*), and southern grasshopper mice (*Onychomys torridus*) in the protected area. These results show that protection from human disturbance has many benefits, including greater overall community biomass and diversity. The significance and generality of these results can be further tested by studying other enclosures of varying age and configurations in different desert regions of the southwestern United States.

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797. Beyond the "climate versus grazing" impasse: Using remote sensing to investigate the effects of grazing system choice on vegetation cover in the eastern Karoo.

Archer, E. R. M.

Journal of Arid Environments 57(3): 381-408. (2004)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: degradation/ grazing/ resilience/ climate/ ecosystem resilience/ grazing management/ land degradation/ NDVI/ remote sensing/ vegetation cover/ Africa/ Karoo Basin/ South Africa/ southern Africa/ sub-Saharan Africa

Abstract: Much research has been directed at determining the relative roles of climate and grazing in driving vegetation cover change in semi-arid ecosystems. Recent attempts seek to move beyond this debate as it has stagnated, or reached an "impasse". This study follows this pathway in investigating the effect of commercial stock grazing practices on vegetation cover in an eastern Karoo study site in South Africa. The study "corrects" a 14-year NDVI time-series for precipitation effects. Results suggest that some grazing strategies lead to consistently lower

vegetation cover measures than do others, once rainfall is accounted for. Such findings provide a basis for recommendations for more sustainable grazing practices under conditions of variable precipitation. © 2003 Elsevier Ltd. All rights reserved.
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798. Big game-livestock relationships study: Vegetal change in the absence of livestock grazing on deer winter range in Red Butte and Emigration canyons, Utah.

Austin, D. D. and Urness, P. J. Utah State Dept. Natural Resources, 1985. 18 p.
Descriptors: cover/ deer, mule/ grazing/ history/ interspecies relationships/ oak/ vegetation/ wildlife-habitat relationships/ wildlife-livestock relationships/ North America/ United States/ Utah/ Red Butte Canyon/ Emigration Canyon/ Wasatch Mountains
Abstract: Objective was to determine change, if any, in the vegetation of Emigration Canyon resulting from withdrawal of livestock grazing in contrast to Red Butte Canyon that has been ungrazed since 1905.
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799. Big sacaton riparian grassland management: Seasonal grazing effects on plant and animal production.

Cox, J. R.; Gillen, R. L.; and Ruyle, G. B.
Applied Agricultural Research 4(2): 127-134. (1989)
NAL Call #: S539.5.A77; *ISSN:* 0179-0374
Descriptors: Sporobolus/ forage/ steers/ Brahman/ range management/ grazing intensity/ natural regeneration/ weight gain/ climatic factors/ seasonal growth/ riparian buffers/ grazing
Abstract: F1 Brahman steers annually grazed the same big sacaton (*Sporobolus wrightii* Monro) pastures in either spring (May 1-June 12), summer (July 1-August 12), or fall (September 1-October 12) for three years. Green forage accumulated gradually in spring, accumulated rapidly in summer and declined gradually in fall, but mean daily steer gains averaged 1.5, 0.8, and 0.5 lb/animal on spring, summer, and fall grazed pastures, respectively. Spring gains were superior because green forage quality was greatest when plants initiated growth in spring. Summer gains were directly affected by green forage quantity, and green forage quantity was dependent on highly variable summer rainfall amounts. Fall gains were consistently low because forage quality declines rapidly in fall when green forage transfers to dead forage. In the three years, more than 80% of the green forage disappeared during spring grazing but pastures recovered in subsequent summer growing seasons. If the land manager wishes to maximize animal production without damaging the renewable natural resource (plant production), it is recommended to graze big sacaton grasslands in spring, avoid these riparian grasslands in dry summers, and discontinue fall grazing. This citation is from AGRICOLA.

800. Biological efficiency from rangelands through management strategies.

Cook, C. Wayne.
In: Proceedings of a conference on multispecies grazing. (Held 25 Jun 1985-28 Jun 1985 at Morrilton, Ark.) Baker, Frank H. and Jones, R. Katherine (eds.)
Morrilton, Ark.: Winrock International Institute for

Agricultural Development; pp. 54-64; 1985.
NAL Call #: SF85.3.P76
Descriptors: range management/ mixed grazing/ sustained yield management/ evaluation criteria/ common lands/ biological value
This citation is from AGRICOLA.

801. Biological implications of rotational grazing.

Gerrish, J. R.
Proceedings of the Forage and Grassland Conference: 6-9. (1991)
NAL Call #: SB193.F59; *ISSN:* 0886-6899
Descriptors: rotational grazing/ pasture plants/ range management/ grazing
This citation is from AGRICOLA.

802. Biotic soil crusts of Oregon's shrub steppe: Community composition in relation to soil chemistry, climate, and livestock activity.

Ponzetti, J. M. and McCune, B. P.
Bryologist 104(2): 212-225. (2001)
NAL Call #: 450 B84; *ISSN:* 0007-2745
Abstract: We examined biotic soil crust cover and composition at nine shrub-steppe sites in central and eastern Oregon, U.S.A. One pair of livestock-grazed and excluded transects was established at each site. Data were collected on the cover of biotic soil crust and vascular plant species, soil surface pH and electrical conductivity, and other environmental variables. Using gradient analysis, we found that differences in community composition among sites were most strongly related to soil pH, electrical conductivity (EC), and Calcareous Index Value (CIV; a scale representing the relative calcium carbonate content of soils). Other important variables included precipitation, elevation, aspect, and temperature. We found total crust cover to be highest at sites with lower pH, EC, and CIV. Dominant species differed markedly between the more calcareous sites with higher pH, and the less calcareous, lower pH sites. Livestock exclusion was not an important gradient in the ordination of these data, being overshadowed by the strong soil chemistry and climate gradients. However, overall community composition of soil crust species was different between grazed and long-ungrazed sites ($p = 0.02$, Blocked Multi-Response Permutation Procedure). Comparison of grazed and long-ungrazed sites revealed lower cover of biotic crusts, nitrogen-fixing lichens, crust-dominated soil surface roughness, and lower species richness in the grazed transects. There was more bare ground in the grazed transects, on average ($p > 0.02$ for all, two-tailed paired t-tests). Our results suggested that total bunchgrass cover was higher within exclosures, but conclusive evidence was lacking ($p = 0.1$, two-tailed paired t-test). Vascular plant composition, cover, richness, shrub cover, electrical conductivity, and pH were not different between the grazed and livestock-excluded transects. Thus, livestock-related reductions in cover and richness of biotic soil crusts were apparent while significant impacts to vascular plants were not obvious. We conclude that 1) biotic soil crusts are sensitive indicators of disturbance and 2) there are strong compositional differences in shrub steppe crust communities of Oregon, which are correlated with regional soil and climate gradients.
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803. Biotic stress and population distribution of primary producers in grassland ecosystem.

Bisht, N. S. and Gupta, S. K.

Indian Journal of Ecology 11(1): 50-56. (1984)

NAL Call #: QH540.156; ISSN: 0304-5250

Descriptors: deforestation/ ecosystems/ range management/ grasslands/ grazing/ population distribution/ India

This citation is from AGRICOLA.

804. Burning and grazing management in a California grassland: Effect on bunchgrass seed viability.

Dyer, Andrew R.

Restoration Ecology 10(1): 107-111. (2002)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: grazing management: management method/ annual grassland/ critically endangered grassland habitats/ grazing/ maternal provisioning/ prescribed fire/ soil seed bank/ vegetation responses

Abstract: Prescribed fire is an important management tool for reducing the dominance of non-native species in annual grasslands; both annual and perennial native species show strong vegetative responses in the subsequent growing season. However, although the post-fire contribution of native species to the seed bank is assumed to be larger than in pretreatment years, the effects on seed quality, particularly viability and longevity, are not well understood. In this study, I germinated *Nassella pulchra* (purple needlegrass) seed that had been stored for 10 years after collection from target plants receiving treatment combinations of summer burning and grazing by sheep. Seeds from burned plants were larger and had higher germinability than seed from unburned plants. Seeds from plants that were both burned and grazed had the highest germination. The strong relationship between long-term viability and seed size suggests greater maternal provisioning and increased seed quality subsequent to burning and grazing. I conclude that managing for seed quality may be a useful approach for conservation of native species in California's critically endangered grassland habitats.

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805. Burning and grazing management in a California grassland: Growth, mortality, and recruitment of *Nassella pulchra*.

Dyer, Andrew R.

Restoration Ecology 11(3): 291-296. (2003)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: burning management/ grassland/ grazing management/ growth/ life history/ mortality/ recruitment/ restoration ecology/ topography

Abstract: Annual grasslands in California are often managed with seasonal grazing and prescribed burning on the assumption that such practices have long-term benefits for native species. Mature native perennial bunchgrasses, particularly *Nassella pulchra* (purple needlegrass), are often the focal species, although very little is known about responses at different life history stages. Thus, important questions remain about long-term population dynamics of both mature plants and seedling recruitment. In plots receiving repeated grazing and burning events over 7 years, mortality of mature plants was threefold higher on mounds than on intermounds and likely reflected increased competition intensity associated with increased resource

availability in deeper soil. Burning and grazing treatments had strong positive effects on basal area of mature *N. pulchra*. However, plants in grazed plots that were not burned contained considerable standing dead biomass. Topographic location strongly influenced growth as intermound plants grew relatively more than mound plants, but the effects on growth of burning and grazing did not vary with topographic location. In mapped plots *N. pulchra* recruitment was very low, and overall density dropped an average of 31%. However, a significant time-by-burning effect indicated that survival was significantly higher in burned plots. After 7 years of repeated treatments, effects of burning and grazing management on mature *N. pulchra* were positive but not for all phenological stages. Understanding long-term influence of management on bunchgrass populations may not be easy to determine because short-term results may not reflect long-term responses and some life cycle dynamics may be observed only over very long periods.

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806. Can grazing response of herbaceous plants be predicted from simple vegetative traits?

Diaz, Sandra; Noy Meir, Imanuel; and Cabido, Marcelo

Journal of Applied Ecology 38(3): 497-508. (2001)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: functional vegetative traits/ grazing responses/ life history traits/ plant height/ range management/ specific leaf area [SLA]/ taxonomy/ temperate subhumid upland grasslands: habitat

Abstract: 1. Range management is based on the response of plant species and communities to grazing intensity. The identification of easily measured plant functional traits that consistently predict grazing response in a wide spectrum of rangelands would be a major advance. 2. Sets of species from temperate subhumid upland grasslands of Argentina and Israel, grazed by cattle, were analysed to find out whether: (i) plants with contrasting grazing responses differed in terms of easily measured vegetative and life-history traits; (ii) their grazing response could be predicted from those traits; (iii) these patterns differed between the two countries. Leaf mass, area, specific area (SLA) and toughness were measured on 83 Argentine and 19 Israeli species. Species were classified by grazing response (grazing-susceptible or grazing-resistant) and plant height (< or > 40 cm) as well as by life history (annual or perennial) and taxonomy (monocotyledon or dicotyledon). 3. Similar plant traits were associated with a specific response to grazing in both Argentina and Israel. Grazing-resistant species were shorter in height, and had smaller, more tender, leaves, with higher SLA than grazing-susceptible species. Grazing resistance was associated with both avoidance traits (small height and leaf size) and tolerance traits (high SLA). Leaf toughness did not contribute to grazing resistance and may be related to selection for canopy dominance. 4. Plant height was the best single predictor of grazing response, followed by leaf mass. The best prediction of species grazing response was achieved by combining plant height, life history and leaf mass. SLA was a comparatively poor predictor of grazing response. 5. The ranges of plant traits, and some correlation patterns between them, differed markedly between species sets from Argentina and Israel. However, the significant relationships between plant traits and grazing response were maintained. 6. The results of this

exploratory study suggest that prediction of grazing responses on the basis of easily measured plant traits is feasible and consistent between similar grazing systems in different regions. The results challenge the precept that intense cattle grazing necessarily favours species with tough, unpalatable, leaves.

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807. Canadian bluejoint response to heavy grazing.

Collins, W. B.; Becker, E. F.; and Collins, A. B.
Journal of Range Management 54(3): 279-283. (2001)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/2001/543/279-283_collins.pdf

Descriptors: Calamagrostis canadensis/ grazing/ cattle/ horses/ plant competition/ wildlife/ woody plants/ phenology/ plant development/ Epilobium angustifolium/ rhizomes/ weight/ biomass/ digestibility/ carbohydrates/ shoots/ nitrogen content/ viability/ chemical constituents of plants/ seed productivity/ Alaska

Abstract: A disclimax stand of Canadian bluejoint (*Calamagrostis canadensis* (Michx.) Beauv.) was heavily grazed by cattle and horses for 4 years to weaken the grass's competition with hardwoods important as browse and cover to wildlife. Stocking at 0.084 ha AUM(-1) resulted in uniform utilization of bluejoint and maintenance of early phenology through the growing season. Etiolated bluejoint declined about 90%, but grass production increased 10 to 15%, as fireweed (*Epilobium angustifolium* L.), a principal herbaceous component of the stand, decreased in response to trampling. Rhizomes of heavily grazed bluejoint had lower total nonstructural carbohydrates (TNC) ($p = 0.0127$), lower weight (g cm(-1) length) ($p = 0.05$), and reduced biomass (g cm(-3) of soil) ($p = 0.05$). Shoots of grazed bluejoint maintained higher nitrogen ($p = 0.0001$) and higher digestibility (IVDMD) ($p = 0.0017$) than bluejoint that was never grazed. This enabled heavily grazed bluejoint to retain good forage quality through the entire growing season, as opposed to ungrazed bluejoint, which became poor forage at the time of flowering during early July. Following one season of rest, rhizome TNC, shoot nitrogen, and IVDMD returned to levels of never grazed bluejoint. Seedhead production, seed production, seed weights, and seed viability of rested bluejoint were about the same as in ungrazed stands. On wet sites, heavy grazing does not adequately reduce the vigor of this grass. This citation is from AGRICOLA.

808. Carbon exchange and species composition of grazed pastures and exclosures in the shortgrass steppe of Colorado.

LeCain, D. R.; Morgan, J. A.; Schuman, G. E.; Reeder, J. D.; and Hart, R. H.
Agriculture, Ecosystems & Environment 93(1/3): 421-435. (2002)
NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: pastures/ steppes/ botanical composition/ carbon/ carbon dioxide/ gas exchange/ biogeochemical cycles/ grazing/ range management/ leaf area index/ seasonal variation/ photosynthesis/ Colorado

Abstract: Grasslands comprise approximately 40% of the world's terrestrial surface. Consequently, grassland ecosystems are a significant component of the global carbon cycle. In order to better understand how grazing affects the carbon cycle of grasslands, this study measured

CO₂ exchange rate (CER) and soil respiration rate (SRR) on 130 ha pastures with a 56-year history of heavy (60% removal) and light (20% removal) grazing, and their accompanying 0.8 ha exclosures, on the shortgrass steppe of northeastern Colorado, USA. A CER chamber that covered 1 m² of native grassland was used on five plots in each of the four areas. Mid-day CER and SRR were measured during the growing seasons of 1995-1997, along with green vegetation index (GVI, similar to leaf area index) and plant species composition. When averaged over each growing season, there was no significant difference in CER of grazed pastures versus exclosures. However, there were seasonal differences in CER, which varied over the 3 years. Differences in CER between grazed pastures and exclosures were not related to GVI, which rarely differed between treatments. Grazing treatment differences in CER were driven by climate variability and species composition differences resulting from long-term grazing and exclusion from grazing. Exclosures had more cool-season (C3) grasses and forbs than grazed plots, which contained more warm-season (C4) grasses (primarily *Bouteloua gracilis* (H.B.K.) Lag. Ex Steud.). The somewhat unique, cool spring of 1995 was favorable to cool-season plant metabolism and resulted in higher CER in exclosures compared with grazed pastures. Warm, dry conditions in spring of 1996 favored warm-season species, resulting in higher CER in the heavily-grazed pasture. In 1997, there was little difference in CER between grazed pastures and exclosures. There were very few sampling dates when SRR was different in grazed pastures and exclosures. This study suggests that these intensities of cattle grazing do not alter the photosynthetic and soil respiration components of the carbon cycle of the US shortgrass prairie. It appears that cattle grazing can be a sustainable component of managing this ecosystem for maximum global carbon sequestration. This citation is from AGRICOLA.

809. Catastrophic vegetation shifts and soil degradation in terrestrial grazing systems.

Koppel, J.; Rietkerk, M.; and Weissing, F. J.
Trends in Ecology and Evolution 12(9): 352-356. (1997)
NAL Call #: QH540.T742; ISSN: 0169-5347

Descriptors: soil degradation/ grazing systems/ vegetation/ overgrazing/ reviews/ natural grasslands/ grasslands/ semiarid grasslands/ salt marshes/ environmental degradation

Abstract: The presence of alternative vegetation states in terrestrial grazing systems is discussed. Early theoretical studies emphasized saturation of herbivore feeding to explain multiple stable states and catastrophic behaviour, but recent studies on semiarid grasslands and arctic salt marshes have related catastrophic events in these systems to plant-soil interactions. A herbivore-induced decrease in vegetation has led to soil degradation and reduced plant growth, and positive feedback between reduced plant standing crop and deteriorated soil conditions has thereby contributed to irreversible vegetation destruction.

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810. Cattle grazing and oak trees as factors affecting soil emissions of nitric oxide from an annual grassland.

Davidson, Eric A.; Herman, Donald J.; and Firestone, Ayelet Schuster.

In: Agricultural ecosystem effects on trace gases and global climate change. (Held 28 Oct 1991 at Denver, Colorado, USA.) Rolston, Dennis Eugene (eds.)

Madison, Wisconsin: Soil Science Society of America; pp. 109-119; 1993.

Notes: ISSN 0066-0566; ISBN 089118113X

NAL Call #: 64.9 Am3 no.55

Descriptors: diurnal variation/ mineralization/ nitrification/ range management/ seasonality/ soil temperature

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811. Cattle grazing impacts on annual forbs and vegetation composition of mesic grasslands in California.

Hayes, Grey F. and Holl, Karen D.

Conservation Biology 17(6): 1694-1702. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: grazing management: applied and field techniques/ coastal prairie community/ disturbance regime/ grazing impacts/ life history guild/ litter depth/ mesic grasslands/ soil chemistry/ species richness/ vegetation composition/ vegetation cover/ vegetation height/ vegetation structure

Abstract: Livestock grazing represents a major human alteration of natural disturbance regimes in grasslands throughout the world, and its impacts on plant communities have been highly debated. We investigated the impact of cattle grazing on the California coastal prairie plant community with a focus on native annual forbs, a number of which are of conservation concern. In spring 2000 and 2001, we surveyed the vegetation community composition, vegetation structure, and soil chemical parameters at 25 paired grazed and ungrazed sites over a 670-km range of the ecosystem. Native annual forb species richness and cover were higher in grazed sites, and this effect was concomitant with decreased vegetation height and litter depth. Soil properties explained less of the variation. Exotic annual grass and forb cover were higher in grazed sites. Native grass cover and species richness did not differ in grazed and ungrazed sites, but cover and species richness of native perennial forbs were higher in ungrazed sites. Our results suggest that cattle grazing may be a valuable management tool with which to conserve native annual forbs in the ecosystem we studied but that grazing differentially affects the various life-history guilds.

Therefore, land managers must focus on creating a matrix of disturbance regimes to maintain the suite of species native to these mesic grasslands. The results of this and other studies highlight the importance of considering the adaptation of vegetation communities to disturbance in making recommendations for grazing management.

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812. Cattle grazing in a hummock grassland regenerating after fire: The short-term effects of cattle exclusion on vegetation in south-western Queensland.

Letnic, M.

Rangeland Journal 26(1): 34-48. (2004)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: prescribed burning/ animal preferences/ grazing intensity/ grazing management/ Eragrostis/ vegetation cover

This citation is from AGRICOLA.

813. Cattle grazing in wetlands on Alamosa/Monte Vista NWR.

Dieboll, R. A. Univ. of Missouri-Columbia, 1999.

Descriptors: birds/ cattle/ cover/ grazing/ history/ mapping/ population density/ refuges, wildlife/ sampling/ size/ soils/ vegetation/ water level/ wetlands/ Aves/ North America/ United States/ Colorado/ San Luis Valley

Abstract: Objectives were to evaluate in classified wetland (drier and wetter) and treatment (grazed and ungrazed) types: (1) successive changes in vegetation structure (vertical density or height at 100 percent coverage) of existing short emergent vegetation; (2) successive changes in tall whitetop (number of rosettes, stems, and seed heads and average height of rosettes and stems); and (3) successive changes in the percent of residual and new baltic rush and new tall whitetop.

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814. Cattle grazing mediates climate change impacts on ephemeral wetlands.

Pyke, Christopher R. and Marty, Jaymee

Conservation Biology 19(5): 1619-1625. (2005)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: climatic changes/ grazing/ feeding behaviour/ amphibiotic species/ environmental impact/ wetlands/ resource management/ vulnerability/ rare species/ hydrology/ environmental effects/ precipitation/ reproduction/ conservation/ temperature effects/ *Ambystoma californiense*/ Caudata/ USA, California/ California tiger salamander/ salamanders

Abstract: Climate change impacts depend in large part on land-management decisions; interactions between global changes and local resource management, however, rarely have been quantified. We used a combination of experimental manipulations and simulation modeling to investigate the effects of interactions between cattle grazing and regional climate change on vernal pool communities. Data from a grazing enclosure study indicated that 3 years after the removal of grazing, ungrazed vernal pools dried an average of 50 days per year earlier than grazed control pools. Modeling showed that regional climate change could also alter vernal pool hydrology. Increased temperatures and winter precipitation were predicted to increase periods of inundation. We evaluated the ecological implications of interactions between grazing and climate change for branchiopods and the California tiger salamander (*Ambystoma californiense*) at four sites spanning a latitudinal climate gradient. Grazing played an important role in maintaining the suitability of vernal pool hydrological conditions for fairy shrimp and salamander reproduction. The ecological importance of the interaction varied nonlinearly across the region. Our results show that grazing can confound hydrologic changes driven by climate change and play a critical role in maintaining the hydrologic suitability of vernal pools for endangered aquatic invertebrates and amphibians. These observations suggest an important limitation of impact assessments of climate change based on experiments in unmanaged ecosystems.

The biophysical impacts of land management may be critical for understanding the vulnerability of ecological systems to climate change.

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815. Cattle trampling of crested wheatgrass *Agropyron-cristatum* under short-duration grazing.

Ralph, D. F. and Malecheck, J. C.

Journal of Range Management 38(3): 226-227. (1985)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1985/383/7balp.pdf>

Descriptors: hoof action/ hoof print/ frequency

Abstract: This paper tests 3 predictions that stem from the hypothesis that Angus heifers avoid stepping on crested wheatgrass (*Agropyron cristatum*) tussocks because the tussocks present an uneven surface upon which to walk: (1) hoofprints are located disproportionately more often in the open spaces between tussocks than on tussocks; (2) the disproportionality persists despite the frequency of hoof prints per unit area; and (3) the more tussocks are elevated above the surrounding substrate, the less they are trampled. The methods relate the observed and expected frequency of hoofprints on tussocks along 2 transects in a crested wheatgrass paddock. The results significantly support all 3 predictions. We conclude that under the conditions that existed, the hoof action hypothesized by some to be of benefit to short-duration grazing pastures was minimal, and so was the hoped-for destruction of standing dead vegetation that deters grazing.

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816. Cattle use affects forage quality in a montane riparian ecosystem.

Phillips, R. L.; Trlica, M. J.; Leininger, W. C.; and Clary, W. P.

Journal of Range Management 52(3): 283-289. (1999)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1999/523/283-289_phillips.pdf

Descriptors: cattle/ *Carex aquatilis*/ *Salix*/ in vitro digestibility/ nitrogen content/ phosphorus/ grazing intensity/ seasonal variation/ riparian buffers

Abstract: Forage nitrogen (N) and phosphorous (P) concentrations and in-vitro dry-matter digestibility (IVDMD) were measured in 2 important riparian species the year following short-term, high-intensity cattle grazing treatments in a montane riparian ecosystem in northcentral Colorado. Current year's growth of water sedge (*Carex aquatilis* Wahlenb.) and planeleaf willow (*Salix planifolia* Pursh.) was collected monthly from May to September 1996. The effects of grazing and season of grazing in 1995 on forage quality the following growing season was determined. Season of grazing (i.e., late-spring, early-summer, late-summer, and fall) the previous year did not differentially affect forage quality in either species. However, grazing by cattle the previous year did increase forage quality of water sedge as compared with plants that were not previously grazed. Grazed water sedge plants had higher concentrations of N and P and greater IVDMD than ungrazed controls. Nitrogen and P concentrations of browsed planeleaf willow were not different from controls, but current year's growth collected in the fall from previously browsed plants was 11% more digestible than current year's growth from non-browsed willow. The 2 species responded uniquely to cattle use, which suggested that these 2 life forms differ in response to

herbivory. This study supported the hypothesis that grazing by cattle would improve forage quality in a riparian ecosystem, although results varied with life form.

This citation is from AGRICOLA.

817. Change in plant spatial patterns and diversity along the successional gradient of Mediterranean grazing ecosystems.

Alados, C. L.; El Aich, A.; Papanastasis, V. P.; Ozbek, H.; Navarro, T.; Freitas, H.; Vrahnakis, M.; Larrosi, D.; and Cabezudo, B.

Ecological Modelling 180(4): 523-535. (2004)

NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: defoliation/ deposition/ diversity/ faeces/

frequency/ grazing/ matorral/ mineralization/ soil compaction/ spatial distribution/ trampling/ urine/ woodlands
Abstract: In this study, we analyze the complexity of plant spatial patterns and diversity along a successional gradient resulting from grazing disturbance in four characteristic ecosystems of the Mediterranean region. Grazing disturbance include not only defoliation by animals, but also associated disturbances as animal trampling, soil compaction, and mineralization by deposition of urine and faeces. The results show that woodland and dense matorral are more resistant to species loss than middle dense and scattered matorral, or grassland. Information fractal dimension declined as we moved from a dense to a discontinuous matorral, increasing as we moved to a more scattered matorral and a grassland. In all studied cases, the characteristic species of the natural vegetation declined in frequency and organization with grazing disturbance.

Heliophyllous species and others with prostrate or rosette twigs increased with grazing pressure, particularly in dense matorral. In the more degraded ecosystem, only species with well-adapted traits, e.g., buried buds or unpalatable qualities showed a clear increase with grazing. Indeed, the homogeneity of species distribution within the plant community declined monotonically with grazing impact. Conversely, the spatial organization of the characteristic plants of each community increased in the better-preserved areas, being also related to the sensitivity of the species to grazing impact. The degree of autocorrelation of plant spatial distribution at the species level and the information fractal dimension at the community level allow us to quantify the degree of degradation of natural communities and to determine the sensitivity of key species to disturbance.

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818. Changes in plant functional groups, litter quality, and soil carbon and nitrogen mineralization with sheep grazing in an Inner Mongolian grassland.

Barger, N. N.; Ojima, D. S.; Belnap, J.; Wang, S.; Wang, Y.; and Chen, Z.

Journal of Range Management 57(6): 613-619. (Nov. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: botanical composition/ steppes/ plant litter/ vegetation cover/ overgrazing/ indicator species/ soil nutrient dynamics/ China

Abstract: This study reports on changes in plant functional group composition, litter quality, and soil C and N mineralization dynamics from a 9-year sheep grazing study in Inner Mongolia. Addressed are these questions: 1) How does increasing grazing intensity affect plant community composition? 2) How does increasing grazing intensity alter

soil C and N mineralization dynamics? 3) Do changes in soil C and N mineralization dynamics relate to changes in plant community composition via inputs of the quality or quantity of litter? Grazing plots were set up near the Inner Mongolia Grassland Ecosystem Research Station (IMGERS) with 5 grazing intensities: 1.3, 2.7, 4.0, 5.3, and 6.7 sheep ha(-1).yr(-1). Plant cover was lower with increasing grazing intensity, which was primarily due to a dramatic decline in grasses, *Carex duriuscula*, and *Artemisia frigida*. Changes in litter mass and percentage organic C resulted in lower total C in the litter layer at 4.0 and 5.3 sheep ha(-1).yr(-1) compared with 2.7 sheep ha(-1).yr(-1). Total litter N was lower at 5.3 sheep ha(-1).yr(-1) compared with 2.7 sheep ha(-1).yr(-1). Litter C:N ratios, an index of litter quality, were significantly lower at 4.0 sheep ha(-1).yr(-1) relative to 1.3 and 5.3 sheep ha(-1).yr(-1). Cumulative C mineralized after 16 days decreased with increasing grazing intensity. In contrast, net N mineralization (NH₄(+) + NO₃(-)) after a 12-day incubation increased with increasing grazing intensity. Changes in C and N mineralization resulted in a narrowing of CO₂-C:net N(min) ratios with increasing grazing intensity. Grazing explained 31% of the variability in the ratio of CO₂-C:net N(min). The ratio of CO₂-C:net N(min) was positively correlated with litter mass. Furthermore, there was a positive correlation between litter mass and *A. frigida* cover. Results suggest that as grazing intensity increases, microbes become more C limited resulting in decreased microbial growth and demand for N. This citation is from AGRICOLA.

819. Changes in plant functional types in response to goat and sheep grazing in two semi-arid shrublands of SE Spain.

Navarro, T.; Alados, C. L.; and Cabezudo, B. *Journal of Arid Environments* 64(2): 298-322. (2006) NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
Descriptors: land management/ applied and field techniques/ drought/ grazing/ regeneration/ clonality/ drought resistance/ ecosystem stability/ canopy structure/ semi arid shrubland/ sclerophilly/ leaf presence/ plant coverage/ phenological deciduousness/
 plant functional type
Abstract: In Mediterranean plant communities, grazing induces severe floristic changes affecting the life histories of grazed and non-grazed species. Alteration of the grazing regimen causes important changes in the structure and dynamics of the plant community and ecosystem stability. To determine the susceptibility of different plant functional types to landscape management, we measured changes in Plant Functional Types (PFTs) in response to grazing by goat and sheep in an inland dwarf-palm matorral and a marine-exposed thorny-shrub matorral in Cabo de Gata Natural Park (SE Spain). We classified the major life forms into PFTs, and identified six PFT shrubs (dwarf-palms, sclerophyllous small trees, xeric thorny-shrubs, spiny legumes, glaucous dwarf-shrubs, and xeric half-shrubs), four PFT forbs (leafy stem herbs, xeric prostrate herbs, rosette herbs, and clonal spiny herbs), and two PFT grasses (steppe and short grasses). Morphological traits measured include sclerophilly, leaf presence, leaf size, shape of leaf margins, hairiness, position of dormant buds (growth form), clonality, plant coverage, canopy structure, phenological deciduousness (drought resistance), and regeneration (reproduction type, pollination type,

inflorescence position, and seed size). There was a higher correlation within and between morphological growth forms, leaf and phenological traits, than within regenerative traits (only seed size was correlated with main dispersal type). We analysed the importance of these PFTs at several sites of the two communities, which were subjected to different livestock rates. In inland and marine-exposed communities, the same PFTs decreased in response to medium-high grazing: sclerophyllous small trees (*Quercus coccifera*, *Olea europaea* var. *sylvestris*), glaucous dwarf-shrubs (*Phlomis* and *Cistus* spp.) and short grasses (*Brachypodium*, *retussum*). In both communities, the decrease of these grazing-susceptible PFTs was widely associated with an increase in steppe grasses (*Stipa tenacissima*, "alfa-grass") and xeric prostrate herbs (*Fagonia cretica*, *Paronichia sufruticosa*), the latter of which is a reliable indicator of degradation in semi-arid systems. Instead, different PFTs behave as either grazing-averse and/or grazing-tolerant in each community: Dwarf-palms (*Chamaerops humilis*) and xeric thorny shrubs (*Periploca laevigata*) in the marine-exposed community, and xeric half-shrubs (*Thymus hiemalys*, *Sideritis osteoxylla*, *Teucrium* spp., *Artemisia herba-alba*) in the inland community. The latter functional group resists disturbances, such as medium-moderate grazing and drought, in semi-arid zones and is an indicator of long-term degradation. (c) 2005 Elsevier Ltd. All rights reserved. © The Thomson Corporation

820. Changes in population biology of two succulent shrubs along a grazing gradient.

Riginos, Corinna and Hoffman, M. Timm *Journal of Applied Ecology* 40(4): 615-625. (2003) NAL Call #: 410 J828; ISSN: 0021-8901
Descriptors: succulent karoo: biome/ fruit production/ grazing gradients/ management implications/ microsite availability/ mortality/ population biology/ recruitment/ reproductive output/ seed production/ seed set/ seedling establishment/ stockposts/ survival/ vegetation composition
Abstract: 1. Heavy livestock grazing in Namaqualand, South Africa, is threatening the region's unique diversity of succulent shrubs. This is especially true in the communally managed lands, where grazing is centred around fixed enclosures (stockposts) in which animals stay overnight. In this study we set out to determine the effects of a semi-permanent stockpost on the composition of the surrounding vegetation and the mechanisms by which grazing limits the persistence of leaf-succulent shrub populations. 2. We used the grazing gradient created by a stockpost to examine the impacts of grazing on vegetation composition and changes in mortality, reproductive output and seedling establishment for the leaf-succulent species *Ruschia robusta* and *Cheiridopsis denticulata*. 3. Vegetation composition was found to change from a community dominated by the unpalatable shrub *Galenia africana* at high grazing intensities to a community dominated by the palatable leaf-succulent shrub *R. robusta* at lower grazing intensities. 4. Mortality of the leaf-succulents *R. robusta* and *C. denticulata* was high at the sites closest to the stockpost, while fruit production and seedling germination were substantially reduced over distances of 800 m and 2 km for the two species, respectively. Seedling establishment was not limited by either grazing or microsite availability. Thus reduction in reproductive output is the greatest impact of heavy grazing on these two species. 5. Synthesis and

applications. This study demonstrates that marked zonation in vegetation composition and population biology can develop around a fixed stockpost and that the greatest impact of grazing on the two leaf-succulent species studied is the suppression of flower and fruit production. Consistent suppression of reproductive output could have long-term consequences for the persistence of succulent shrub populations in the heavily grazed communal lands of Namaqualand. We recommend that (i) herders should be encouraged to relocate their stockposts regularly to prevent the development of centres of degradation, and (ii) areas should be relieved periodically of all grazing pressure to allow for successful seed set of native shrubs.

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821. Changes in the composition of *Carex bigelowii*-*Racomitrium lanuginosum* moss heath on Glas Maol, Scotland, in response to sheep grazing and snow fencing.

Welch, David; Scott, David; and Thompson, Des B. A. *Biological Conservation* 122(4): 621-631. (2005)
 NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: botanical composition/ grazing intensity/ moss heath/ nitrogen deposition/ sheep grazing/ snow fencing
Abstract: *Carex bigelowii*-*Racomitrium lanuginosum* moss heath has high conservation value in Britain, being one of the most extensive near-natural habitats and also the preferred habitat of dotterel (*Eudromias morinellus*). This rare and attractive bird has declined in Britain in the past century, and loss of *Racomitrium* heath due to heavy sheep grazing and/or nitrogen deposition is probably responsible. Erection of snow fencing for a ski corridor across *Carex-Racomitrium* heath on Glas Maol, a mountain rising to 1068 m in the eastern Highlands, affected sheep (*Ovis aries*) usage, and so gave an opportunity to compare trends in botanical composition under different grazing intensities. We began monitoring in 1990, four years after the fence's erection, and report trends up to 2002/03. Adjacent to the fencing (0-10 m away) sheep usage was much increased due to improved shelter, and *C. bigelowii* and *R. lanuginosum* declined, the latter sharply. *Racomitrium* cover was already reduced by a third in 1990, and fell by a further third over the next 12 years. Grass cover increased to nearly equal *Carex* cover 16 years after the fence erection. *Dicranum Juscenscens* also spread but lichens declined. There was longer snow-lie near the fence, this being correlated with sheep usage despite somewhat different incidence, and logistic regression showed that for the 1990-1996/97 period *Racomitrium* loss was rather more closely related to snow-lie than to sheep pellet-group density, whereas *Agrostis* increase was highly significantly related to pellet-group density. Distant to the fence the composition of the *Carex-Racomitrium* heath changed little over 12 years of monitoring. *Agrostis* increased and *C. bigelowii* declined, both changes being significant but much smaller than adjacent to the fence. Also *Polytrichum alpinum* increased significantly and some lichens declined. For *Racomitrium* there was a fall of only 2.5% from its initial cover of 40% in 1990. Since the dung counts showed only a negligible reduction in sheep usage between plots at 13-15 and 43-45 m from the fence, the trends in composition recorded at positions 19-20 and 39-40 m from the fence apply to the extensive moss heath used by the dotterel on Glas Maol. These birds still nest in the distant zone, and we judge that the condition of the *Carex-Racomitrium* heath will

remain satisfactory for them unless sheep usage increases by 25% or more. However, the ongoing loss of lichens and the sparsity of *Vaccinium myrtillus* imply that the current level of sheep grazing has appreciably modified this community from its former pristine condition. Copyright 2004 Elsevier Ltd. All rights reserved.

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822. Changes in vegetation structure after long-term grazing in pinyon-juniper ecosystems: Integrating imaging spectroscopy and field studies.

Harris, A. Thomas; Asner, Gregory P.; and Miller, Mark E. *Ecosystems* 6(4): 368-383. (2003)
 NAL Call #: QH540 .E3645; ISSN: 1432-9840

Descriptors: airborne hyperspectral remote sensing: applied and field techniques/ geostatistical analysis: mathematical and computer techniques/ imaging spectroscopy: laboratory techniques, spectrum analysis techniques/ spectral mixture analysis: laboratory techniques, spectrum analysis techniques/ biogeophysical properties/ community composition/ ecosystem changes/ field studies/ land use/ landscape management/ long term grazing [overgrazing]/ mesa rangelands/ pinyon juniper rangelands/ relict areas/ spatial autocorrelation/ vegetation cover/ vegetation structure/ woody encroachment
Abstract: We used field studies and imaging spectroscopy to investigate the effect of grazing on vegetation cover in historically grazed and ungrazed high-mesa rangelands of the Grand Staircase-Escalante National Monument, Utah, USA. Airborne hyperspectral remote sensing data coupled with spectral mixture analysis uncovered subtle variations in the key biogeophysical properties of these rangelands: the fractional surface cover of photosynthetic vegetation (PV), nonphotosynthetic vegetation (NPV), and bare soil. The results show that a high-mesa area with long-term grazing management had significantly higher PV (26.3%), lower NPV (54.5%), and lower bare soil (17.2%) cover fractions in comparison to historically ungrazed high-mesa pinyon-juniper rangelands. Geostatistical analyses of remotely sensed PV, NPV, and bare soil were used to analyze differences in ecosystem structure between grazed and ungrazed regions. They showed that PV was spatially autocorrelated over longer distances on grazed areas, whereas NPV and bare soil were spatially autocorrelated over longer distances on ungrazed areas. Field data on the fractional cover of PV, NPV, and bare soil confirmed these remote sensing results locally. Field studies also showed a significantly higher percentage composition of shrubs (27.3%) and forbs (30.2%) and a significantly lower composition of grasses (34.4%) and cacti (1.1%) in grazed areas. No significant difference between grazed and ungrazed mesas was found in percentage composition of trees or in the number of canopies per hectare. Our combined remote sensing and field-based results suggest that grazing has contributed to woody thickening in these pinyon-juniper ecosystems through an increase in shrubs in the understory and intercanopy spaces. These results improve our understanding of broad-scale changes in pinyon-juniper ecosystem structural composition and variability due to long-term grazing.

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823. Comparative effects of stock and wild vertebrate herbivore grazing on treeless subalpine vegetation, Eastern Central Plateau, Tasmania.

Bridle, K. L. and Kirkpatrick, J. B.

Australian Journal of Botany 47(6): 817-834. (1999)

NAL Call #: 450 Au72; ISSN: 0067-1924

Abstract: The existence of two 25-year-old grazing exclosures on Liawenee Moor, Eastern Central Plateau, Tasmania, created an opportunity to investigate the impacts of vertebrate herbivores on treeless subalpine vegetation. There were three treatments: sheep-, native herbivore- and rabbit-grazed; native herbivore and rabbit-grazed; no grazing. The amount of bare ground was highest in the sheep-grazed plots, while vegetation cover was greatest in the ungrazed exclosure. The cover of all lifeform groups, except small herbs, was greater in the exclosures than in the sheep-grazed plots. The percentage frequency of tall herbs was significantly less in the sheep-grazed plots than either of the grazing exclosures. Tall herbs were more likely to be found under the canopy of other vegetation in the sheep-grazed plots while the same species were found to be growing in locations with no other vegetation cover in the ungrazed exclosure. Revegetation of bare ground averaged 1% per year over a 20-year period in the ungrazed exclosure. While percentage bare ground has also decreased in the native- and rabbit-grazed exclosure, it has increased in the sheep-grazed plots. Domestic stock grazing appears to have a much greater impact on vegetation cover, species composition and community structure than grazing by native herbivores and rabbits. No grazing allows for the fastest rehabilitation of the area. Our results are consistent with those from alpine and treeless subalpine areas of the Australian mainland.

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824. A comparison of sheep grazing with herbicides for weed control in seedling alfalfa in the irrigated Sonoran Desert.

Bell, Carl E.; Guerrero, Juan N.; and Granados, Elda Y.

Journal of Production Agriculture 9(1): 123-129. (1996)

NAL Call #: S539.5.J68; ISSN: 0890-8524

Descriptors: crop industry/ agriculture/ agronomy/ biobusiness/ herbicide/ Imperial Valley/ pest assessment control and management/ seedling/ selective grazing/ sethoxydim/ Sonoran Desert/ 2,4 db amine

Abstract: A three year study was conducted in the irrigated Sonoran Desert to compare the effect of different weed management methods in seedling alfalfa (*Medicago sativa* L.) on crop stand and yield. Treatments included; grazing with sheep (*Ovis aries* L.) when the crop was ready for the first harvest, a combination of preemergence and postemergence herbicides, postemergence herbicides only, and an untreated control where weeds were harvested with the hay. Weed management practice did not affect alfalfa yield in the first season, although the herbicide treatments reduced total forage (alfalfa plus weeds) yield compared with the grazed treatments and the untreated control. Crop density was not different between treatments. Herbicide treatments lowered forage yields at the first harvest by eliminating of weeds and because of crop injury in 2 of the 3 yr. At the third and subsequent harvests, there were no differences in forage yield for treatments. Plots were weed free after the second harvest. Lamb grazing selectivity in weedy seedling alfalfa was also quantified by analyzing esophageal extrusa. The lambs were selecting the weeds

over the alfalfa as grazing progressed. This preference was consistent between lambs and plots, although there were year differences. Forage quality of the winter annual broadleaf weeds present in this study was comparable with the alfalfa. We concluded that grazing lambs are a good weed control method in seedling alfalfa during the winter grazing season in the irrigated Sonoran Desert.

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825. Comparison of species composition between different grassland management treatments after 25 years.

Moog, D.; Poschlod, P.; Kahmen, S.; and Schreiber, K. F.

Applied Vegetation Science 5(1): 99-106. (2002)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: botanical composition/ controlled burning/ grassland management/ grasslands/ grazing/ mowing/ mulching/ nature conservation/ plant succession

Abstract: To identify management treatments suitable for the conservation of extensively managed grasslands, the 'Fallow experiments in Baden-Wurttemberg' were set up in 1975. In this investigation, species composition of the grazing, mowing, mulching, controlled burning and unmanaged (succession) treatments were analysed after 25 yr of continuous management in *Arrhenatherum elatius* and *Bromus erectus* grasslands. Through ordination analyses it was found that species composition is strongly dependent on the management treatment. The first axis, identified by ordination analysis, essentially corresponded to a gradient of decreasing disturbance frequency. Controlled burning resulted in a unique species composition. Grazing, mowing and mulching twice a year were found to be most suitable for the conservation of unimproved, species-rich grasslands.

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826. A comparison of the effects of different rangeland management systems on plant species composition, diversity and vegetation structure in a semi-arid savanna.

Smet, M. and Ward, D.

African Journal of Range and Forage Science 22(1): 59-71. (2005)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: commercial livestock ranching: applied and field techniques/ communal livestock ranching: applied and field techniques/ game ranching: applied and field techniques/ grazing intensity/ plant species diversity/ vegetation structure/ plant species composition/ semi arid savanna/ bare soil frequency

Abstract: Most of South Africa's land surface is and or semi-arid rangeland. Three management systems exploit these areas: commercial livestock ranching, communal livestock ranching and game ranching. The ways in which these management systems affect rangeland ecology is contentious due to inherent differences in management characteristics and the controversy surrounding driving forces in rangeland vegetation dynamics. We used 500m-long grazing gradients around water-points in order to evaluate the effects of grazing intensity on plant species composition and diversity, and to compare levels of degradation among management systems. We compared species composition, bare soil frequency, shrub and tree density among management systems. We conclude that

grazing has significant negative effects in these rangelands, although differences in degree of degradation could have been confounded by factors other than grazing.

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827. Compatibility of livestock grazing strategies with riparian-stream systems.

Platts, W. S.

In: Range watersheds, riparian zones and economics: Interrelationships in management and use: Proceedings, 1984 Pacific Northwest Range Management Short Course, Corvallis, Or.: Oregon State University, 1984; pp. 67-74
NAL Call #: QH541.5.R3P3 1984

Descriptors: livestock/ range management/ grazing/ riparian buffers/ rangelands/ streams

This citation is from AGRICOLA.

828. Complementary grazing of reclaimed mined land and native rangeland pastures in Montana.

DePuit, E. J. and Coenenberg, J. G.

In: Proceedings of the conference: Reclamation, A Global Perspective. (Held 27 Aug 1989-31 Aug 1989 at Calgary, Alberta, Canada.); pp. 185-195; 1989.

Descriptors: liveweight gain/ grazing/ mined land
Abstract: A 3-year grazing study was conducted on Montana coal-mined lands revegetated with introduced cool-season grasses and legumes. Objectives were to determine the responses of mined land vegetation and soils to cattle grazing, and to evaluate the capability of mined land-vegetation to support livestock under 2 rotational grazing systems: exclusive grazing of mined land pastures season-long, and complementary mined land/native rangeland grazing. Spring and late summer grazing improved productivity of mined land vegetation, induced certain changes in plant species composition and diversity, and positively influenced certain soil attributes. Forage quality and animal liveweight gain data demonstrated highest utility of the introduced plant species for spring grazing, and lower value during the summer when animal performance on native range pastures was superior to that on mined land pastures. Total spring/summer cattle gains were higher with the complementary mined land-native rangeland grazing system than with the exclusive mined land system, although exclusive grazing of mined land vegetation produced acceptable season-long cattle gains.

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829. Complex effects of grazing treatment on an annual in a species-poor grassland community.

Silvertown, J.; Watt, T. A.; Smith, B.; and Treweek, J. R.

Journal of Vegetation Science 3(1): 35-40. (1992)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: Geranium/ range management/ community ecology/ mortality/ reproduction/ seeds/ sowing/ sheep/ grazing/ England

This citation is from AGRICOLA.

830. Composition and production of California oak savanna seasonally grazed by sheep.

Bartolome, J. W. and McClaran, M. P.

Journal of Range Management 45(1): 103-107. (1992)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1992/451/21bart.pdf>

Descriptors: sheep/ Quercus douglasii/ annual grasslands/

savannas/ botanical composition/ seasonal variation/ grazing/ California

Abstract: Seasonal grazing trials, conducted over 3 years at the Hopland Field Station in Mendocino County, Calif., tested the effects of 2 seasonal grazing strategies on within- and between-year production and composition in blue oak (*Quercus douglasii* H.A.) savanna understory and adjacent open annual grassland. Moderate intensity summer-fall-winter and spring-summer sheep use had few within-year effects. In contrast, production and composition varied considerably between years in both treatments. Forbs (especially legumes) decreased in open grassland and oak understory between years within both seasonal grazing regimes. This change could not have been caused by selective grazing because there were no corresponding within-year patterns. Instead, between-year changes are more likely related to nonselective effects of stocking rate and/or weather. Results from this study suggest that seasonal grazing systems offer little potential for improvement of annual range composition.

This citation is from AGRICOLA.

831. Consequence of grazing pattern and vegetation structure on the spatial variations of net N mineralisation in a wet grassland.

Rosignol, N.; Bonis, A.; and Bouzille, J. B.

Applied Soil Ecology 31(1-2): 62-72. (2006)

NAL Call #: QH541.5.S6 A67; ISSN: 0929-1393

Descriptors: grasslands/ wet environmental conditions/ grazing intensity/ plant communities/ community structure/ nitrogen mineralization/ spatial variation/ habitat fragmentation/ soil nutrients/ nutrient availability

This citation is from AGRICOLA.

832. Consequences of protection from grazing on diversity and abundance of the coastal lowland vegetation in eastern Saudi Arabia.

Shaltout, K. H.; El Halawany, E. F.; and El Kady, H. F.

Biodiversity and Conservation 5(1): 27-36. (1996)

NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: evenness/ species diversity/ species richness
Abstract: Fourteen years of protection against grazing and human impacts of the coastal lowland vegetation in Eastern Saudi Arabia (an experimental site in the vicinity of Al-Hassa region) has led to an increase of 68% in the total cover, 33% in species richness and 32% in species relative abundance in the protected area are important forage and/or fuel plants. Soil salinity and important soil nutrients (N, K, Mg and Na) are significantly higher in the free grazing area which may be attributable to the fact that the passage of herbage through the grazing animals often enhances nutrient availability.

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833. Conservation implications of grazing practices on the plant and dipteran communities of a turlough in Co. Mayo, Ireland.

Ryder, C.; Moran, J.; Donnell, R.; and Gormally, M.

Biodiversity and Conservation 14(1): 187-204. (2005)

NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: plant communities/ species richness/ habitat/ stocking/ conservation/ vegetation/ basins/ grazing/ aquatic insects/ species diversity/ plant populations/ stocking density/ biodiversity/ flooding/ community composition/

vegetation cover/ Diptera/ Sciomyzidae/ Eire, Connaught, Mayo/ marsh flies

Abstract: Turloughs, which are classified as priority habitats under the European Habitats Directive, are seasonally flooded depressions found almost exclusively in Ireland. In 2001, three adjacent fields with different stocking densities were selected and plant/dipteran communities within the same vegetation zone of each field (site) were investigated using quadrats and sweep netting, respectively. There was a significant positive relationship between Diptera morphospecies richness/Diptera abundance and mean vegetation height ($P < 0.001$). However, no significant relationship between Diptera morphospecies richness and plant species richness was found. Median Diptera morphospecies richness per sweep was lower at the site with the highest stocking density (17) than at the other two sites (22 and 31, respectively). Total species richness of Sciomyzidae was greater at the least grazed site (7) than at the more heavily grazed sites (2 and 1, respectively). The results suggest that an evaluation of turlough management practices based on plant communities alone is not sufficient and that at least some areas within the turlough basin remain ungrazed on a rotational basis to ensure maximum diversity of Diptera.
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834. Conservation of biodiversity in managed rangelands, with special emphasis on the ecological effects of large grazing ungulates, domestic and wild.

Duncan, Patrick and Jarman, Peter J.
International Grassland Congress: Proceedings 17(3): 2077-2084. (1993); ISSN: 0074-6185

Descriptors: ungulates/ Ungulata/ *Bos taurus*/ conservation/ damage/ grazing/ ecosystems/ mammals/ rangeland/ species diversity/ cattle/ prairie/ diversity
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835. Conservation strategy of a nature reserve in Mediterranean ecosystems: The effects of protection from grazing on biodiversity.

Verdu, Jose R.; Crespo, Manuel B.; and Galante, Eduardo
Biodiversity and Conservation 9(12): 1707-1721. (2000)
NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: mediterranean ecosystems/ conservation guidelines [conservation regulations]/ conservation strategies/ cultural measures/ ecological measures/ economic measures/ endemism/ environmental management/ environmental protection/ grassland habitat/ grazing/ integrated rural policies/ land use/ landscape ecology/ nature reserves/ species richness

Abstract: Protection of natural areas has caused the elimination of traditional grazing activity on many occasions. As a result, in Mediterranean ecosystems a loss of biodiversity is usually related to a decrease of grassland and grassland-bush mosaic areas. In order to establish relationships between land use and the relative importance of each type of habitat in terms of species richness and endemism, the Font Roja Natural Park in Alicante Province (SE Iberian Peninsula) was studied. Four sites were selected representing the four different existing habitats: a wooded area (holm-oak forest), a dense shrubland, a dense grassland, and a grassland-shrubland mosaic area. In each site, the species composition of vegetation and dung beetle fauna were analysed. The results showed that the highest diversity and endemism, for plants and beetles,

were concentrated in the dense grasslands and the grassland-shrubland mosaic. Thus, controlled grazing activity of sheep and goats which maintained a diverse variegated landscape would favour the historical sustenance of the biodiversity of Mediterranean ecosystems, as that would allow a remarkable diversity of habitats with higher conservation levels of existing species richness and endemism. Therefore, we propose a reintroduction of traditional grazing of sheep and goats throughout ecological, cultural and economical measures, which would include guidelines and regulations, set out to boost an integrated rural policy.

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836. The contribution of managed grasslands to sustainable agriculture in the Great Lakes Basin.

Clark, E. A. and Poincelot, R. P.
Journal of Sustainable Agriculture 8(2/3): 1-172. (1996)
NAL Call #: S494.5.S86S8; ISSN: 1044-0046

Descriptors: farming systems/ range management/ pastures/ soil conservation/ water conservation/ nutrients/ environmental management/ grazing/ crop production/ biogeochemical cycles/ livestock production/ literature reviews/ Ontario

This citation is from AGRICOLA.

837. Cover of perennial grasses in southeastern Arizona in relation to livestock grazing.

Bock, C. E. and Bock, J. H.
Conservation Biology 7(2): 371-377. (1993)
NAL Call #: QH75.A1C5; ISSN: 0888-8892

Abstract: Southwestern grama (*Bouteloua*) grasslands are floristically allied to the North American Central Plains but lie outside the historic range of the plains' principal ungulate grazer, *Bison bison*. The authors compared perennial grassland cover and species composition on eight sites transected by the boundary fence of a 22 yr old livestock enclosure in a grama grassland in SE Arizona. Total grass canopy cover was greatest on the ungrazed portion of each of the eight sites. Two short stoloniferous species (*Hilaria belangeri* and *Bouteloua eriopoda*) were the only taxa substantially more abundant on grazed quadrats overall. Among these and eight taller bunchgrasses, there was a strong positive correlation between potential height and response to release from grazing with the three tallest species showing the greatest increases on ungrazed treatments (*Bouteloua curtipendula*, *Bothriochloa barbinodis*, and *Eragrostis intermedia*). *Bouteloua gracilis*, the most abundant grass in the region, showed an intermediate response to livestock exclusion. Grama grasslands at the Arizona site have changed more and in different ways following livestock exclusion than those on the Central Plains of Colorado. Contributing factors may include: 1) greater annual precipitation at the Arizona site, 2) the much larger size of the Arizona livestock enclosure, and 3) the absence of extensive grazing by native ungulates in the Southwest since the Pleistocene. -from Authors

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838. Crested wheatgrass and shrub response to continuous or rotational grazing.

Angell, R. F.

Journal of Range Management 50(2): 160-164. (1997)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1997/502/160-164_angell.pdf

Descriptors: Agropyron desertorum/ Artemisia tridentata/ Chrysothamnus viscidiflorus/ rotational grazing/ stocking rate/ tillers/ plant density/ canopy/ rain/ biomass/ steers
Abstract: A four-year study was conducted to investigate effects of continuous and short duration grazing in spring on standing crop and tiller density of crested wheatgrass [Agropyron desertorum (Fisch. ex Link) Schult], along with changes in cover and density of Wyoming big sagebrush (Artemisia tridentata Nutt. subsp. wyomingensis Beetle and Young) and green rabbitbrush [Chrysothamnus viscidiflorus (Hook.) Nutt.]. Eight pastures were each stocked with 10 steers (224 kg) beginning in early May. Four grazing treatments consisted of continuous grazing at 0.6 AUM/ha (CONT) or short duration grazing management at 0.6, 0.9, and 1.2 AUM/ha for LOW, MED, and HIGH treatments, respectively. After 4 years, mean tiller density was greatest on LOW paddocks ($P = 0.10$) (707 tillers/m²). Tiller density on HIGH paddocks did not differ ($P > 0.05$) from CONT. Density of large (> 15-cm tall) Wyoming big sagebrush increased (P less than or equal to 0.05) across years, but did not vary ($P > 0.05$) among treatments, at about 9 plants/100 m². Sagebrush plants < 15-cm tall responded differently ($P = 0.02$) in CONT compared to HIGH. Small sagebrush density increased under short duration grazing at doubled stocking rate (HIGH) compared to CONT, but LOW and MED did not differ from CONT. We concluded that short duration rotation grazing at a conventional stocking rate decreased neither tillering nor yield of crested wheatgrass. Shrub density and cover changes on LOW were similar to CONT. It does appear, however, that short duration grazing at the doubled stocking rate has the potential to limit crested wheatgrass productivity over time because of enhanced sagebrush seedling survival. This citation is from AGRICOLA.

839. Demographic variation in the Australian desert Cassia under grazing pressure.

Silander, J. A.

Oecologia (Berlin) 60(2): 227-233. (1983)

NAL Call #: QL750.O3; ISSN: 0029-8549

Descriptors: Cassia nemophila/ sheep/ rabbit/ model

Abstract: Demographic variation was examined in 3 populations of the Australian desert shrub Cassia nemophila which vary in their grazing histories. Age-specific life tables were constructed from 50 yr of observations on mortality and recruitment at the Koonamore Vegetation Reserve in South Australia. Population projection matrix models were used to examine population responses to grazing pressure. The predicted population growth rates, reproductive values and stable age distributions are evaluated and compared with observed results. Grazing by sheep or rabbits, in high populations, prevents shrub recruitment and causes local population extinction. Where protected from sheep and with low rabbit pressure, Cassia populations have increased. Current sheep grazing practices and rabbit population levels if continued will have

a drastic affect on Cassia populations and other shrub species, and on the structure and composition of the Australian arid shrublands in general.

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840. Desertification processes due to heavy grazing in sandy rangeland, Inner Mongolia.

Zhao, H. L.; Zhao, X. Y.; Zhou, R. L.; Zhang, T. H.; and Drake, S.

Journal of Arid Environments 62(2): 309-319. (2005)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: biomass/ desertification/ grazing/ ground cover/ plant height/ rangelands/ roots/ wind damage/ wind effects/ wind erosion/ Nei-Mongol

Abstract: We conducted a grazing experiment from 1992 to 1996 in Inner Mongolia to explore desertification processes of sandy rangeland. The results show that continuous heavy grazing results in a considerable decrease in vegetation cover, height, standing biomass and root biomass, and a significant increase in animal hoof impacts. As a result, small bare spots appeared on the ground and later merged into larger bare areas in the rangeland. Total bare area reached up to 52% and the average depth of wind erosion was 25 cm in the fifth year of the study. We conclude that sandy rangeland with wind-erodible soil is susceptible to desertification. Heavy grazing of such rangeland should be avoided.

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841. Differences in plant composition in cattle and wild ungulate exclosures in north-central Montana.

Hurlbert, Kris and Bedunah, Don.

In: Sharing Common Ground on Western Rangelands: Proceedings of a Livestock/Big Game Symposium. (Held February 26-28 (1996) at Sparks, Nevada.) Evans, Keith E. (eds.); Vol. INT-GTR-343.

Ogden, Utah: U.S. Department of Agriculture Forest Service, Intermountain Research Station; pp. 19-24; 1996.

Notes: ISSN: 0363-6186

NAL Call #: aSD11.A48

Descriptors: nutrition/ diet/ ecology/ habitat/ terrestrial habitat/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Cervus elaphus/ Odocoileus hemionus (Cervidae): food plants/ impact on habitat/ grassland plant community/ impact of grazing/ grassland/ grazing impact on plant community/ Montana/ dupuyer/ grazing impact on grassland plant community/ Cervidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ vertebrates

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842. Differences in riparian vegetation structure between grazed areas and exclosures.

Tucker Schulz, T. and Leininger, W. C.

Journal of Range Management 43(4): 295-299. (1990)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1990/434/4schu.pdf>

Abstract: Differences in vegetation structure were examined in a montane riparian zone in N-central Colorado after 30 yr of cattle exclusion and continued, but reduced, grazing pressure. Total vascular vegetation, shrub, and graminoid canopy cover was greater in the exclosures as compared to grazed areas, while forb canopy cover was similar between treatments. Exclosures had nearly 2 times the litter cover, while grazed areas had 4 times more bare ground. Willow canopy coverage was 8.5 times greater in

protected areas than in grazed areas. Kentucky bluegrass *Poa pratensis* cover was 4 times greater in grazed areas than enclosures, while the cover of fowl bluegrass *Poa palustris* was 6 times greater in the protected sites. Canopy cover of other important riparian species was similar between treatments. Mean peak standing crop was 2410 kg/ha in enclosures and 1217 kg/ha in caged plots within grazed areas. Cattle utilized c65% of the current year's growth of vegetation during the grazing season. – from Authors

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843. Differences in species richness and life-history traits between grazed and abandoned grasslands in southern Sweden.

Dupre, Cecilia and Diekmann, Martin

Ecography 24(3): 275-286. (2001)

NAL Call #: QH540.H6; ISSN: 0906-7590

Descriptors: abandoned grasslands/ community composition/ grazed grasslands/ grazing/ life history traits/ management type/ spatial scale/ species richness

Abstract: Disturbance has profound effects on plant community composition. This paper deals with the influence of grazing on species richness and proportions of life-history attributes of grassland vegetation at six spatial scales (0.001-1000 m²) in two provinces of southern Sweden. The study comprised 33 dry grassland sites, including 22 grazed and 11 abandoned localities, and 28 sites of coastal brackish meadows, divided into five management types (from "heavily grazed" to "abandoned since long time"). In general grazed sites were species-richer than abandoned sites, especially at small plot sizes. However, there was a steeper increase in species number towards larger plot sizes in the abandoned sites. Heavy grazing in the coastal meadows resulted in a comparatively low number of species, corroborating the intermediate disturbance hypothesis. The analysis of life-history traits indicated the importance of taxonomic group, canopy structure, height, regenerative strategy and, in particular, life form. Leaf anatomy and seed dispersal seemed to be less important. The responses to grazing as regards species traits differed somewhat between grassland types. Grazed sites generally had high proportions of legumes, therophytes, species with basal position of leaves and with regeneration by means of a persistent seed bank. Abandonment of grazing favoured monocots, geophytes, species with vegetative regeneration and (partly) leafy canopy structure. Some differences between grazed and abandoned sites were confined to either the smallest or largest plot sizes, indicating different responses of matrix and interstitial species. Various positive associations (attribute syndromes) or negative associations between individual traits were identified. There was, for example, a positive link between the attributes "geophytes" and "ability of vegetative regeneration". The recognition of such links is important to avoid misinterpreting certain attributes as functional adaptations to grazing while they are only positively correlated to other attributes of larger significance.

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844. Differing effects of cattle grazing on native and alien plants.

Kimball, Sarah and Schiffman, Paula M.

Conservation Biology 17(6): 1681-1693. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: grazing management: applied and field techniques/ adaptations/ compensation/ competition/ differential grazing effects/ growth/ herbivory/ native grassland community/ population restoration/ reproduction

Abstract: Habitat managers use cattle grazing to reduce alien plant cover and promote native species in California grasslands and elsewhere in the western United States. We tested the effectiveness of grazing as a restoration method by examining the effects of herbivory on native and alien plants. At Carrizo Plain National Monument, California, we surveyed native and alien species cover in adjacent grazed and ungrazed areas. We also established experimental plots in which plants were clipped or mulch (dead biomass) was removed. In addition, we clipped plants grown in pots and plants in the field that grew with and without competitors. Native species were negatively affected by clipping in 1999, 2000, and 2001, whereas alien species were unaffected. In the experimental field plots, the European annual forb *Erodium cicutarium* compensated in growth and reproduction following simulated herbivory. In contrast, growth and reproduction of the native perennial bunchgrass *Poa secunda* were reduced 1 year after clipping. In pots, *E. cicutarium* overcompensated and grasses undercompensated. In the field, European grasses were unaffected by the removal of competitors. It is unclear by what mechanism *E. cicutarium* was able to compensate, but the ability may be related to its basal rosette growth form and indeterminately growing inflorescences. The native California grassland community assembled in the absence of grazing herds, whereas invasive European species have been exposed to grazing for centuries. It may be that these invaders have adaptations that better enable them to recover from grazing. In the grassland we studied, the strategy of livestock grazing for restoration is counterproductive. It harms native species and promotes alien plant growth.

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845. The distribution of grazing pressure in relation to vegetation resources in semi-arid west Africa: The role of herding.

Turner, Matthew D.; Hiernaux, Pierre; and Schlecht, Eva

Ecosystems 8(6): 668-681. (2005)

NAL Call #: QH540 .E3645; ISSN: 1432-9840

Descriptors: multiple regression analysis: mathematical and computer techniques/ spatial distribution/ grazing/ distribution/ management/ semi arid/ vegetation resource/ herding/ agropastoralism/ cropped land/ agropastoral landscape/ cultivation pressure/ land unit/ palatable forage mass/ itinerary/ forage availability time/ grazing period/ labor investment

Abstract: In semi-arid West Africa, livestock are increasingly managed by sedentary producers in close proximity to expanding cropped lands. To evaluate the agricultural and environmental implications of this trend, a study was conducted to investigate the effect of grazing management on the spatial distribution of grazing pressure, the forage provided animals during the grazing period, and local herd-forage ratios across three agropastoral landscapes characterized by varying cultivation pressure.

During the 19-month study period, data on herbaceous vegetation, livestock populations, and grazing itineraries were collected. These data were referenced to land units averaging 70 ha in area. Using this approach, each of 3,819 grazing itineraries was characterized as to: 1. the sum of the products of the palatable forage mass of a particular land unit and the time spent grazing by the herd within that unit (FAT, expressed in kg-hours ha⁻¹); and 2. the average palatable herbaceous forage mass encountered by livestock across the itinerary weighted by the time spent in the land units crossed (FA, expressed in kg ha⁻¹). The spatial dispersion of livestock grazing around human settlements was found to decline with a reduction in herding labor investment (herded > herd-release > free pasture). Multiple regression analyses of itinerary data demonstrate that both FAT and FA also decline with a reduction in herding labor investment. Herded and herd-release managed livestock were offered more palatable forage and grazed areas of higher forage availability than free-pastured animals. This supports arguments that as the investment of time and effort into herding declines, feed supply to livestock will decline and the potential for grazing-induced environmental change will increase.

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846. Does grazing reduce survival of indigenous perennial grasses of the semi-arid woodlands of western New South Wales?

Grice, A. C. and Barchia, I.

Australian Journal of Ecology 17(2): 195-205. (1992)

NAL Call #: QH540.A8; ISSN: 0307-692X

Descriptors: Stipa nitida/ Aristida browniana/ Eragrostis eriopoda/ Monachather paradoxa/ livestock/ rabbit/ kangaroo/ sheep/ interspecific variation/ rangeland management

Abstract: Exclosures were used to examine the impact of grazing upon the mortality patterns of populations of six indigenous grass species. The experiment compared unfenced areas with areas from which either sheep only or sheep, rabbits and kangaroos were excluded. There were large interspecific differences in mortality patterns, with *Stipa nitida* and *Aristida browniana* having relatively high mortality rates and *Eragrostis eriopoda* having relatively low mortality rates. Grazing-induced mortality was observed in treatment areas that were grazed by sheep, rabbits and kangaroos and in areas grazed only by rabbits and kangaroos. The short-lived *S. nitida* appears less likely to suffer grazing-induced mortality than species of intermediate longevity such as *Monachather paradoxa*. These observations help explain the decline in endemic perennial grasses that has taken place in the vegetation of western New South Wales since European settlement. Management of these rangelands to encourage these grasses must consider total grazing pressure and not simply the impact of livestock.

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847. Drought and grazing patch dynamics under different grazing management.

Teague, W. R.; Dowhower, S. L.; and Waggoner, J. A.

Journal of Arid Environments 58(1): 97-117. (2004)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: continuous grazing: applied and field techniques/ grazing management: applied and field

techniques/ rotation grazing: applied and field techniques/ arid environment/ drought/ grazing patch dynamics/ land deterioration: uneven animal impact

Abstract: Land deterioration does not occur uniformly over time or over a landscape. The differential use of preferred areas in the landscape results in uneven distribution of animal impact, and periods of below average precipitation compound the effects of herbivory, providing periods of accelerated deterioration. This study investigates whether rotational grazing during a drought cycle allows reduction of deterioration caused by patch-selective grazing in large (1800-2100 ha) paddocks by providing adequate rest between grazing events. From 1995 through 2000, herbaceous and bare ground changes were measured on adjacent heavily grazed and lightly grazed patches in rotationally and continuously grazed paddocks. The weather interacted with grazing treatment ($p < 0.0001$), species ($p < 0.0001$) and the combined effects of the other factors ($p < 0.0014$), indicating the dominant effect of weather, particularly precipitation, on changes in herbaceous basal area. When summer growing conditions were favorable, the rotational grazing treatment resulted in greater increases of perennial herbaceous basal areas ($p < 0.05$) and lower proportions of bare ground ($P < 0.10$) than the continuously grazed treatment. Although rotational grazing did not prevent deterioration in basal area and bare ground with the series of four drought years, it did decrease the rate of deterioration. The changes in basal area were primarily due to changes in summer growing perennial C4 midgrasses and C4 shortgrasses. Grazing treatment did not influence species aerial biomass composition ($p > 0.1$). When monitoring to effect sustainable use, the commonly used parameter of species composition appears to be a much less sensitive indicator of change than bare ground and basal area. This study provides evidence that, in large paddocks in this environment, rotational grazing can reduce the deterioration and allow improvement of both shortgrass and midgrass patches. Copyright 2003 Elsevier Ltd. All rights reserved.

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848. Dynamic optimal management of wind-erosive rangelands.

Hu, D.; Ready, R.; and Pagoulatos, A.

American Journal of Agricultural Economics 79(2):

327-340. (1997)

NAL Call #: 280.8 J822; ISSN: 0002-9092

Descriptors: soil conservation/ grazing/ wind erosion/ rootstocks/ livestock/ rangelands/ land management/ dynamic models/ equations/ economic impact/ semiarid zones/ China

Abstract: A bioeconomic model of livestock production from wind-erosive rangelands is developed and optimized. Equations of motion capture the impact of topsoil stock on forage productivity and the protective effect of forage stock on soil loss from wind erosion. For overgrazed wind-erosive rangelands, a lower discount rate provides incentives for lighter grazing, as does consideration of effect of stocking rates on animal performance. In the case where off-site damages are large, internalizing off-site effects would also encourage lighter grazing and hence promote sustainable production. An illustrative application of the model is also included.

This citation is from AGRICOLA.

849. The dynamics of grazed woodlands in southwest Queensland, Australia and their effect on greenhouse gas emissions.

Moore, J. L.; Howden, S. M.; Mckeon, G. M.; Carter, J. O.; and Scanlan, J. C.

Environment International 27(2-3): 147-153. (2001)

NAL Call #: TD169.E54; ISSN: 0160-4120

Descriptors: GRASP: dynamic tree growth population inclusion, gas emission component inclusion, modeling method, pasture production model/ stock management: changes, management method/ agricultural productivity greenhouse gas reduction conflict/ burning practices: changes/ climate change/ grazed semiarid rangeland: greenhouse gas source/ grazed woodlands: dynamics, greenhouse gas emissions/ grazing

Abstract: This study outlines the development of an approach to evaluate the sources, sinks, and magnitudes of greenhouse gas emissions from a grazed semiarid rangeland dominated by mulga (*Acacia aneura*) and how these emissions may be altered by changes in management. This paper describes the modification of an existing pasture production model (GRASP) to include a gas emission component and a dynamic tree growth and population model. An exploratory study was completed to investigate the likely impact of changes in burning practices and stock management on emissions. This study indicates that there is a fundamental conflict between maintaining agricultural productivity and reducing greenhouse gas emissions on a given unit of land. Greater agricultural productivity is allied with the system being an emissions source while production declines and the system becomes a net emissions sink as mulga density increases. Effective management for sheep production results in the system acting as a net source (approx 60-200 kg CO₂ equivalents/ha/year). The magnitude of the source depends on the management strategies used to maintain the productivity of the system and is largely determined by starting density and average density of the mulga over the simulation period. Prior to European settlement, it is believed that the mulga lands were burnt almost annually. Simulations indicate that such a management approach result in the system acting as a small net sink with an average net absorption of greenhouse gases of 14 kg CO₂ equivalents/ha/year through minimal growth of mulga stands. In contrast, the suppression of fire and the introduction of grazing results in thickening of mulga stands and the system can act as a significant net sink absorbing an average of 1000 kg CO₂ equivalents/ha/year. Although dense mulga will render the land largely useless for grazing, land in this region is relatively inexpensive and could possibly be developed as a cost-effective carbon offset for greenhouse gas emissions elsewhere. These results also provide support for the hypothesis that changes in land management, and particularly, suppression of fire is chiefly responsible for the observed increases in mulga density over the past century.
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850. Dynamics of vegetation along and adjacent to an ephemeral channel.

Smith, M. A.; Dodd, J. L.; Skinner, Q. D.; and Rodgers, J. D.

Journal of Range Management 46(1): 56-64. (1993)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/461/9smit.pdf>

Descriptors: streams/ plant density/ grasses/ perennials/ annuals/ pastures/ woody plants/ deserts/ floodplains/ precipitation/ riparian buffers/ grazing/ highlands/ Wyoming
Abstract: Ephemeral channels may be greater contributors to nonpoint sediment loads than perennial channels because of their abundance and lower vegetative cover.

This study examines above- and belowground standing crop responses of selected vegetation classes and density of shrubs to grazing use and yearly weather variation along an ephemeral stream in northcentral Wyoming. Aboveground biomass standing crop was determined yearly in channel, floodplain, and upland habitats in ungrazed and grazed pastures during the 4-year study. Belowground biomass and shrub densities were determined yearly in the channel habitat only. Perennial grass standing crop in channels did not respond to grazing but decreased up to 73% with decreases in frequency and amount of precipitation. In floodplains, perennial grasses were not responsive to grazing; annual grasses were twice as abundant in grazed pastures. Vegetation standing crop in uplands was not influenced by grazing. Over the study period in all pastures, standing crop of blue grama (*Bouteloua gracilis* (H.B.K.) Lag. ex Griffiths) declined 4 fold while cool-season grasses increased 5 fold. Shrub density did not increase as much in grazed as in ungrazed pastures. Root biomass of the channel decreased 23% in years with less precipitation but was greater by 24% on concave than convex bank types. Location on channels influenced root biomass but grazing did not. Lack of general negative grazing influences on vegetation suggest short periods (10 days) of grazing as used in this study represent a sustainable management alternative for grazing in the cold desert.
This citation is from AGRICOLA.

851. Early season utilization of mountain meadow riparian pastures.

Clary, W. P. and Booth, G. D.

Journal of Range Management 46(6): 493-497. (1993)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/466/5clar.pdf>

Descriptors: beef cattle/ grazing intensity/ grazing/ Idaho
Abstract: Observations suggest spring grazing of riparian areas is a good management strategy because of a reduced tendency for cattle to concentrate along streams during that season. In this study, June cattle distribution was examined within 4 experimental pastures located along Stanley Creek, Sawtooth National Recreation Area, Sawtooth National Forest, in central Idaho. Two pastures were grazed at a light stocking rate and 2 pastures were grazed at a medium stocking rate. Streamside graminoid utilization averaged about 24% under light stocking, while on the adjacent meadow graminoid utilization was 28%. Under medium stocking the average utilization at streamside was 37%, while that on the adjacent meadow was 50%. Residual herbaceous stubble heights under light stocking were 11 to 12 cm for both grazing locations, whereas streamside and meadow stubble heights were 10 cm and 7 cm, respectively, under moderate stocking. Cattle were not disproportionately attracted to the streamside areas during the June period. As stocking rates increased from light to medium, the cattle concentrated most of their additional use on the adjacent drier meadow. Utilization of riparian plant communities during this early summer period

had no relationship to the amount of plant moisture content, but was negatively associated with surface soil moisture.

This citation is from AGRICOLA.

852. Ecological benefit of strip grazing with a solar mobile fence grazing system.

Puga, D. C. and Galina, M. A.

South African Journal of Animal Science 34(Suppl. 1): 89-91. (2004)

NAL Call #: SF1.S6; ISSN: 0375-1589

Descriptors: solar mobile fence grazing system: applied and field techniques/ strip grazing: applied and field techniques/ rural community/ ecological benefit

Abstract: A study was conducted on 14 ha of *Caducifolia* thorny forest with an average total dry matter yield of 800 kg/ha/year. The area of study was divided into two 7 ha camps. Thirty-five Alpine goats were allocated to one of the camps in a continuous grazing system, called the free grazing (FG) camp treatment. Another 35 goats were placed in the other camp where strip grazing was controlled by means of a solar mobile grazing (SMG) system. A high (163 AU/ha) and a low (40.8 AU/ha) stocking rate, allocating 625 m² and 1.250 m², respectively, were applied in the SMG treatment. The number of goats varied to adjust stocking rate daily. The goats were allowed to graze five hours/day. Herbage utilization was measured, using as initial markers the grass length of 24 to 30 cm and number of leaves (156-17) on selected shrub branches, 40 cm. long. The botanical composition was determined at the beginning and end of the grazing period. Chemical analyses of forage selected by the goats were performed monthly. In the SMG treatment the average grass height changed from 37.1 cm. in June to 65.2 cm in February, while percentage leaves changed from 18.4% to 5.9%, compared to changes of 41.4 cm to 42.3 cm and 16.3% to 0.91% in the FG treatment, respectively. In the SMG treatment the goats spent 80% of their time browsing in July and August and 100% of their time from December until March. It is concluded that the economical and social status of the rural community would be improved using the SMG system.

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853. Ecological heterogeneity in the effects of grazing and fire on grassland diversity.

Harrison, S.; Inouye, B. D.; and Safford, H. D.

Conservation Biology 17(3): 837-845. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: biomass variation/ ecological heterogeneity/ ecosystem productivity/ fire/ grassland diversity/ grazing/ landscape ecology/ nonserpentine soils/ serpentine soil/ soil disturbance interactions/ species composition/ species diversity: exotic, native/ species invasion/ species richness

Abstract: Grazing and fire are major forces shaping patterns of native and exotic species diversity in many grasslands, yet both of these disturbances have notoriously variable effects. Few studies have examined how landscape-level heterogeneity in grassland characteristics, such as soil-based variation in biomass and species composition, may contribute to variation in the effects of fire or grazing. We studied the effects of livestock grazing and fire in a mosaic of serpentine and nonserpentine soils in California, where most grasslands are dominated by exotic annuals and serpentine soil is the major refuge for native

grassland species. We predicted that the effects of disturbance would be proportional to productivity and therefore would be greater on nonserpentine than serpentine soils. We measured species composition at 80-100 grazed or ungrazed sites for 2 years before (1998-1999) and 2 years after (2000-2001) an autumn wildfire. Both disturbances increased total species richness on both soils. However, fire enhanced total and exotic species richness more on nonserpentine soils and enhanced native species richness more on serpentine soils. Grazing increased native species richness on serpentine soils but not on nonserpentine soils. These soil-disturbance interactions suggest that the use of fire and grazing to manage native species diversity in wildlands must be done with careful attention to background ecological heterogeneity.

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854. Ecological principles for increasing grazing capacity of Tersko-Kumsk sands.

Zalibekov, Z. G.; Gasanova, S. M.; Yarullina, N. A.; and Magomedov, G. G.

Problems of Desert Development 4: 1-8. (1987)

NAL Call #: QK938.D4P73; ISSN: 0278-4750

Descriptors: cattle/ grazing intensity/ rangelands/ arid zones/ sandy loam soils/ range management/ climatic factors/ ecosystems/ water management/ grazing/ ecological balance/ Russia

This citation is from AGRICOLA.

855. Ecosystem changes associated with grazing intensity on the Punta Ninfas rangelands of Patagonia, Argentina.

Beeskow, A. M.; Ellisalde, N. O.; and Rostagno, C. M.

Journal of Range Management 48(6): 517-522. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/486/517-522_beeskow.pdf

Descriptors: rangelands/ grazing intensity/ botanical composition/ grasses/ woody weeds/ shrubs/ steppes/ sheep/ indicator species/ overgrazing/ forage/ biomass/ canopy/ soil types/ Argentina

Abstract: Changes in the vegetation and soil surface were assessed along a grazing intensity gradient on rangelands of the Punta Ninfas area in southern Argentina. Thirty-two transects were sampled in areas with different grazing intensity. Bray-Curtis polar ordination and simple correlation were used to display changes in community composition and measure association between different community attributes. The first axis expressed the changes in species composition along a gradient of grazing intensity. The extremes of the gradient were represented by shrub and grass steppes. Shrub steppes dominated in heavily grazed areas close to permanent water points, while grass steppes dominated in lightly grazed areas in the extremes of the paddocks. A significant negative relation ($r = -0.81$, $p < 0.05$) between grass and shrub cover suggested that grasses decreased as shrub increased. *Flechilla* (*Stipa tenuis* Phil.) and *flechilla negra* [*Piptochaetium napostaense* (Speg.) Hackel ap Stuckert.] were the main decreaser grasses while *quilembai* (*Chuquiraga avellanadae* Cav.) was the main shrub invading the grass steppes. Uneroded soil surface conditions decreased, and the size and frequency of crusted and desert pavement areas and mounds increased with shrub cover. Three states or stages of range

degradation were identified along the gradient of grazing intensity. Grass steppe represented the most desirable state in term of livestock production and soil stability, while shrub steppe represented the most degraded and least productive state.

This citation is from AGRICOLA.

856. Edge effects in grazed and ungrazed western Australian wheatbelt remnants in relation to ecosystem reconstruction.

Scougall, S. A.; Majer, J. D.; and Hobbs, R. J.
In: Reconstruction of fragmented ecosystems; Series: Nature Conservation Series 3.
Chipping Norton, New South Wales, Australia: Surrey Beatty and Sons, 1993; pp. 163-178.
Notes: Meeting Information: Workshop, Tammin, Western Australia, Australia; October 7-11, 1991; ISBN 0949324507
NAL Call #: QH541.15.R45R42 1993
Descriptors: book chapter/ conservation/ habitat reconstruction/ meeting paper/ vegetation
© The Thomson Corporation

857. Effect of 6 years livestock exclusion on palatable range vegetation of Banda Daud Shah, Kohat.

Noor, Mohammad; Khan, Mohammad; and Nabi, Gul
Pakistan Journal of Forestry 41(3): 126-129. (1991)
NAL Call #: 99.8 P17; *ISSN:* 0030-9818
Descriptors: forage yield/ livestock grazing/ pasture succession
Abstract: A one hectare livestock enclosure was established at Banda Daud Shah (Pakistan) in 1972, to study changes in vegetation and secondary succession. In May, 1978 vegetation in the enclosed and adjacent grazed areas was sampled to detect changes in vegetation. Average yield and species composition of grasses, forbs and trees/shrubs were not significantly different in the enclosed and adjacent grazed areas. The higher (P ltoreq 0.05) forage production and composition of *Aristida depressa* in the grazed area showed that this species increased under continued grazing. Frequency of grasses, forbs and trees/shrubs was not affected by the exclusion of livestock. The data indicate that direct manipulations in semi-arid environment are essential for rapid improvement of overgrazed rangelands and secondary succession.
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858. The effect of cattle and sheep grazing on salt-marsh vegetation at Skallingen, Denmark.

Jensen, A.
Vegetatio 60(1): 37-48. (1985)
NAL Call #: 450 V52; *ISSN:* 0042-3106
Descriptors: grazing/ salt marshes/ succession/ plant communities/ environmental impact/ vegetation cover/ ecological succession/ effects on/ vegetation/ cattle and sheep/ vegetation cover/ ecological succession/ Puccinellian maritima/ Denmark, Skallingen/ succession/ plant communities
Abstract: The aggregated effect of cattle and sheep grazing on Puccinellion maritimae and other salt-marsh vegetation has been studied together with changes in species composition, the percentage cover of each species, total cover and the percentage of bare ground, six years after grazing had been prevented by construction of experimental enclosures. The species composition of the Puccinellia maritima community did not change during

these six years. During the same period of time *Salicornia europaea*, *Suaeda maritima*, and *Glaux maritima*, disappeared from the plot in the ungrazed marsh as a result of natural development. During thirty-five years the vegetation originally dominated by *P. maritima* and *S. europaea* has changed into a community dominated by *Halimione portulacoides*, whereas the grazed salt marsh is still dominated by *P. maritima* and *S. europaea*.
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859. Effect of cattle grazing on range perennial grasses in the Mendoza plain, Argentina.

Guevara, J. C.; Stasi, C. R.; and Estevez, O. R.
Journal of Arid Environments 34(2): 205-213. (1996)
NAL Call #: QH541.5.D4J6; *ISSN:* 0140-1963
Descriptors: grazing/ selective grazing/ frequency/ diversity/ grasslands/ savannas/ stocking rate/ grazing systems/ continuous grazing/ rotational grazing
Abstract: An open xerophytic savanna and shrubland in the north-central Mendoza plain was subjected to 6 different cattle grazing treatments in 1990-94; continuous stocking or a 4-pasture, 1-herd system, each at stocking rates to give 80, 50 or 20% removal of perennial grasses. Vegetation was analysed along 30-m fixed line transects. Rotational grazing at the high stocking rate decreased total live basal cover, proportion and frequency of occurrence of preferred grasses. Rotational grazing to give 50% grass removal, and continuous grazing at the lowest stocking rate, were beneficial.
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860. The effect of clearing bushes and shrubs on range condition in Borana, Ethiopia.

Angassa, Ayana
Tropical Grasslands 36(2): 69-76. (2002)
NAL Call #: SB197.A1T7; *ISSN:* 0049-4763
Descriptors: botanical composition/ bush clearing effects/ bush encroachment response/ communal grazing area/ range conditions/ rangeland management/ shrub clearing effects/ soil condition/ tropical grasslands
Abstract: The effect of bush encroachment and the responses of range condition to clearing were assessed at 2 locations in Borana rangeland at the end of the growing season on cleared and uncleared sites. The study was carried out in a communal grazing area (Medhecho) and a Government ranch (Dida-Tuyura) in bush and/or shrub-encroached and cleared areas to assess the effect of bush clearing on range condition. In each area, 3 elevation ranges were distinguished and in each range a single transect, covering both uncleared and cleared rangeland, away from water sources, was selected. The assessment was based on botanical composition of the herbaceous layer, basal cover, litter cover, relative number of seedlings, age distribution of grasses and soil condition. A total of 31 grasses, 4 legumes and 3 sedges were identified. The grasses *Bothriochloa radicans*, *Cenchrus ciliaris*, *Chrysopogon aucheri* and *Panicum coloratum* were common or dominant in both cleared and uncleared sites. *Pennisetum mezianum* was typically found in encroached vegetation. In general, the range condition was fair to good. The uncleared vegetation had a significantly lower score for range condition than the cleared vegetation for most parameters as well as for total score, although the differences were small. Differences based on elevation range were also significant for grass composition, soil

condition and total score. Cleared areas contained more desirable species and more seedlings than the uncleared areas.

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861. Effect of exclosure and topography on rehabilitation of overgrazed shrub-steppe in the loess plateau of northwest China.

Hongo, Akio; Matsumoto, Satoshi; Takahashi, Hidenori; Zou, Houyan; Cheng, Jimin; Jia, Hengyi; and Zhao, Zhiyi
Restoration Ecology 3(1): 18-25. (1995)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: calcium/ carbon/ grazing/ nitrogen/ organic matter/ precipitation/ soil sample chemical analysis/ species diversity/ water balance

Abstract: The purpose of this study was to clarify the effect of grazing exclosures on the recovery and rehabilitation of overgrazed steppe vegetation on varying slope aspects in the Loess Plateau of northwest China. The annual precipitation in the area studied was 400-480 mm. Soil samples were taken on nine slopes in the five-year exclosure and on five slopes outside the exclosure after a vegetation survey; they were then analyzed chemically. Mean number of species recorded per 0.25 m² was lower on the south-facing slope than all other slopes. The reverse trend was observed for aerial biomass. Species diversity estimated by information content was higher in the grazing zone than in a 3200-ha protected zone within an exclosure. From species ordination by principal component analysis, species with lower coverage in the grazing zone were *Poa sphondylodes*, *Roegneria purpurascens*, *Hierochloa odorata*, and *Potentilla bifurca*, which are all recognized as indicator species for rehabilitation efforts. In the soil surface layer, calcium contents were low, and the total contents of carbon and nitrogen were high on the north-facing slope in the exclosure. The protection by exclosure of overgrazed steppe was seen to be effective because the accumulation of soil organic matter increased and water balance improved.

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862. Effect of fertilizer applications and grazing exclusion on species composition and biomass in wet meadow restoration in eastern Washington.

Beebe, John; Everett, Richard L.; Scherer, George; and Davis, Carl F.

U S Forest Service Pacific Northwest Research Station Research Paper PNW RP(542): 1-15. (2002)

NAL Call #: A99.9 F7625Uni no. 542

<http://www.fs.fed.us/pnw/pubs/rp542.pdf>

Descriptors: biomass/ fertilizer applications: restoration strategy/ grazing exclusion: restoration strategy/ optimum fertilization rates/ soil bulk density/ soil compaction reduction/ species composition/ split block design/ wet meadow restoration

Abstract: Fertilizer applications and grazing exclusion were used as restoration strategies in degraded wet meadows in eastern Washington to grow biomass in the root systems where it could not be grazed. We used a split-block design to test vegetation responses to six fertilizer rates, eight fertilizer types, and three grazing treatments after three growing seasons. Little change in plant composition was detected, but weed biomass was reduced by 50 percent in cattle plus elk grazing. Although forb shoot biomass did not increase, grass shoot biomass doubled but was influenced

by grazing treatments. Root biomass doubled under fertilizer applications. A 10-percent decline in soil bulk density suggested a reduction in soil compaction. These responses were attributed to the increased root biomass. Optimum fertilization rates of 100 kg/ha were recommended along with carefully administered grazing schedules for meadow community restoration.

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863. Effect of fire and grazing on forbs in the western south Texas plains.

Ruthven, Donald C.; Gallagher, James F.; and Synatzske, David R.

Southwestern Naturalist 45(2): 89-94. (2000)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: fire: prescribed burn/ forb density/ herbaceous canopy cover/ livestock grazing/ plains/ species diversity/ species frequency

Abstract: The effects of fire in plant communities in the western South Texas Plains are not clearly understood. Our objective was to compare forb density, cover, frequency, and diversity on prescribed-burned rangelands and untreated rangelands under controlled conditions, and with the influence of livestock grazing during the first growing season after treatment. Four rangeland sites that were burned during winter 1997, and four sites of untreated rangeland were selected on the Chaparral Wildlife Management Area, Dimmit Co., Texas. Two burned and two untreated sites were subjected to grazing by cattle. Herbaceous canopy cover and forb density were estimated with 20- by 50-cm quadrats during late spring 1997. Forb diversity was similar between treatments. Forb coverage was greater on burned than nonburned sites. Important seed-producing annuals, such as prairie sunflower (*Helianthus petiolaris*) and croton (*Croton*), were more prevalent on burned sites. Day flower (*Commelina erecta*), a beneficial perennial, also increased following burning. Grazing did not appear to influence the presence of forbs on burned sites; however, grazing reduced density and cover values of desirable species such as prairie sunflower.

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864. The effect of grazing abandonment on species composition and functional traits: The case of Dehesa grasslands.

Peco, Begona; De Pablos, Isabel; Traba, Juan; and Levassor, Catherine

Basic and Applied Ecology 6(2): 175-183. (2005)

NAL Call #: QH540 .B37; ISSN: 1439-1791

Descriptors: detrended correspondence analysis: mathematical and computer techniques/ grazing: applied and field techniques/ species composition/ vegetation composition/ functional trait/ clonal reproduction/ grazing abandonment/ dehesa grassland

Abstract: This study attempts to identify the consequences of grazing abandonment for changes in floristic and functional vegetation composition in dehesa systems. Species cover was quantified in plots on grazed and abandoned dehesas in Central Spain. Using literature and field measurements, we analysed plant attributes linked to dispersal, establishment, and persistence for the 85 most abundant species. A Detrended Correspondence Analysis of the species x plots matrix and the traits x plots matrix was used to describe differences in species composition and functional traits in relation to grazing. The latter matrix

was obtained by multiplying the traits x species matrix by the species x plots matrix. Grazed sites had a higher proportion of prostrate species, medium specific Leaf area, early flowering, cryptophytes, unassisted seeds and clonal reproduction. Ungrazed sites had a higher proportion of taller plants, heavy Leaf dry weight, Late flowering species and chamaephytes as well. as species with heavy seeds and fruits with adhesive structures. (c) 2005 Elsevier. All rights reserved.

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865. Effect of grazing and abandoned cultivation on a Stipa-Bouteloua community.

Dormaar, J. F.; Adams, B. W.; and Willms, W. D.

Journal of Range Management 47(1): 28-32. (1994)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1994/471/6dorm.pdf>

Descriptors: Hesperostipa comata/ Bouteloua gracilis/ botanical composition/ rangelands/ range management/ soil properties/ soil organic matter/ abandoned land/ prairies/ Alberta

Abstract: A Stipa-bouteloua community, cultivated in the autumn of 1928 and abandoned in the spring of 1932, reverted to a community dominated by needle-and-thread (*Stipa comata* Trin. and Rupr.). An enclosure to prevent grazing was constructed in 1978 to include equal portions of previously cultivated and adjacent native range, while the remainder of the area continued to be subjected to moderate to heavy grazing pressure. This permitted a study to determine the effects of the brief period of cultivation on forage production, species recovery, and soil physical and chemical characteristics compared to those of native prairie. After 14 years of protection from grazing, needle-and-thread accounted for 79% of foliar cover of the abandoned cultivation and 18% of the untreated range while blue grama [*Bouteloua gracilis* (HBK.) Lag. ex Steud] occupied 1 and 51% on the same treatments, respectively. After 60 years, the soil on the abandoned cultivated area showed reduced carbon, total nitrogen, available phosphorus, and hydraulic conductivity but increased N03-N. Grazing reduced hydraulic conductivity, NH4-N, available mineralizable nitrogen (chemical index), available phosphorus, and total carbohydrates but increased carbon, total nitrogen, and N03-N. Cultivation and grazing resulted in reduced root mass. To facilitate a rapid transition from blue gramb to needle-and-thread stable communities, input of energy, such as cultivation, may well be required. This citation is from AGRICOLA.

866. The effect of grazing management on the botanical composition of annual pastures grazed by cattle.

Greathead, K. D.

Proceedings of the Australian Society of Animal Production 18: 220-223. (1990)

NAL Call #: 49.9 AU72; ISSN: 0728-5965

Descriptors: cattle/ grazing/ range management/ botanical composition

This citation is from AGRICOLA.

867. Effect of grazing on plant attributes and hydrological properties in the sloping lands of the East African Highlands.

Taddese, Girma; Mohamed Saleem, M. A.; Astatke, Abyie; and Wagnew, Ayaleneh

Environmental Management 30(3): 406-417. (2002)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: biomass/ cattle dung/ erosion/ grazing/ hydrology/ infiltration/ sloping land/ species richness

Abstract: Extending livestock grazing to the steep slopes has led to unstable grazing systems in the East African Highlands, and new solutions and approaches are needed to ameliorate the current situation. This work was aimed at studying the effect of livestock grazing on plant attributes and hydrological properties. The study was conducted from 1996 to 2000 at the International Livestock Research Institute at Debre Ziet Research Station. Two sites were selected: one at 0-4% slope, and the other at 4-8% slope. The treatments were: (1) no grazing (control); (2) light grazing, 0.6 animal unit months per hectare (aum/ha); (3) moderate grazing, 1.8 aum/ha; (4) heavy grazing, 3.0 aum/ha; (5) very heavy grazing, 4.2 aum/ha; (6) initially plowed and continuously very heavily grazed, 4.2 aum/ha. The result showed that species richness, infiltration rate, bare ground, and soil loss significantly varied with grazing pressure. Species richness was higher in grazed plots compared to nongrazed plots. Biomass yield improved on heavily grazed plots as cow dung accumulated over years. *Cynodon dactylon* plant species persisted with livestock grazing pressure in both sites. Infiltration rate improved and soil erosion declined in all treatments after the first year.

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868. Effect of grazing on soil and plant covers in North Kazakhstan desert.

Asanov, K. A.; Alimaev, I. I.; and Smailov, K.

Problems of Desert Development(2): 5-10. (1992)

NAL Call #: QK938.D4P73; ISSN: 0278-4750

Descriptors: soil water content/ vegetation types/ grazing/ rangelands/ animal husbandry/ soil physics/ soil chemistry/ soil properties/ grasslands/ arid grasslands/ overgrazing/ grazing systems/ rotational grazing

Abstract: In rangelands of the North Kazakhstan desert, unregulated use of land has had an adverse effect on both plant cover and soil fertility. The hydro-physical properties of the soil have worsened. Humus content in topsoil layers has declined to 40% of its initial level. Rotated controlled pasturing exhibits no negative impact on the soil. Moreover, use of grazing lands at 65% of their full capacity favours grass stand self-regeneration and enrichment with ephemeral and perennial plants.

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869. The effect of grazing on the abundance of wild wheat barley and oat in Israel.

Noy Meir, I.

Biological Conservation 51(4): 299-310. (1990)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: Triticum dicoccoides/ Hordeum spontaneum/ Avena sterilis/ cattle/ grasslands/ perennial grass cover

Abstract: Differences in percentage cover of wild cereal species between the two sides of fences with different intensities of cattle grazing were recorded at 14 sites in mediterranean grasslands in northern Israel where these species are native. The cover of the tall wild cereal grasses (*Triticum dicoccoides*, *Hordeum spontaneum*, *Avena sterilis*), individually and combined, was in most sites significantly and substantially higher on the protected or more lightly grazed side of the fence, and showed a strong negative correlation with grazing intensity. It was also negatively correlated with perennial grass cover. The

results support the hypothesis that the distribution of the wild progenitors of cereals in the Middle East has been restricted by millennia of heavy livestock grazing to refuge habitats, and suggests that an important mechanism has been the relative vulnerability of these grasses to close grazing in the growing season. It is suggested that considerable variation in attributes affecting tolerance of grazing or clipping may be found among present wild populations. In any in situ conservation programmes the effects of grazing management on both abundance and genetic diversity of the populations will have to be considered.

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870. The effect of grazing on the structure of a high plateau grassland in central Argentina.

Pucheta, E.; Diaz, S.; and Cabido, M.

Coenoses 7(3): 145-152. (1992); ISSN: 0393-9154

Descriptors: enclosure/ floristics/ morphological change

Abstract: Floristic and morphological changes produced by grazing were studied in a high plateau grassland. Two types of disturbance were compared: an enclosed site without grazing during the last twelve years, and a site grazed by cattle and sheep. The effect of grazing on floristic composition and community architecture was analyzed. Grazing produced changes in species frequency, but not an invasion of exotic species. Five groups of species with differing morphology were identified. These morphological groups were represented in a markedly different way in the two grazing types. Grazing caused the occurrence of morphological groups comprised of grazing tolerants, whereas, within the enclosure, groups of species that evade grazing predominated.

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871. The effect of long-term exclusion of large herbivores on vegetation in Murchison Falls National Park, Uganda.

Smart, N. O. E.; Hatton, J. C.; and Spence, D. H. N.

Biological Conservation 33(3): 229-245. (1985)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: Acacia sieberiana/ herbivores/ national parks/ natural regeneration/ plant ecology/ vegetation/ grazing/ Uganda

This citation is from AGRICOLA.

872. Effect of manure on grazing lands in Ethiopia, East African highlands.

Tadesse, Girma; Peden, Don; Abiye, Astatke; and Wagnew, Ayaleneh

Mountain Research and Development 23(2): 156-160. (2003)

NAL Call #: GB500.M68; ISSN: 0276-4741

Descriptors: international livestock research institute/ afro-montane grasslands: habitat/ biomass productivity/ botanical composition/ grazing lands/ grazing pressure/ highlands/ manure/ soil physical properties/ species richness/ water infiltration rates

Abstract: Biomass productivity, botanical composition, and soil physical properties were studied under conditions with and without application of manure. The study was conducted at the Debre Zeit station of the International Livestock Research Institute, located 5 km from Addis Ababa in the Ethiopian highlands. The aim of the study was to assess the effect of manure on botanical composition,

plant biomass, and water infiltration rates. There were 3 treatments: no grazing, moderate grazing (MDG=1.8 animal unit months (AUM)/hectare), and, heavy grazing (HVG=4.2 AUM/hectare), each replicated 4 times. Removing cow dung from grazed plots decreased biomass production. Species richness was higher on manured plots than on nonmanured plots. The water infiltration rate was low on grazed and nongrazed plots with no manure when compared with the manured plots.

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873. The effect of prairie management practices on mycorrhizal symbiosis.

Bentivenga, S. P. and Hetrick, B. A. D.

Mycologia 84(4): 522-527. (1992)

NAL Call #: 450 M99; ISSN: 0027-5514

Descriptors: Glomus ambisporum/ vesicular arbuscular mycorrhizae/ tallgrass prairie/ burning/ mowing/ grazing/ fertilization/ nitrogen/ phosphorus/ root colonization

Abstract: The effects of tallgrass prairie management practices, burning, mowing (simulated grazing), and fertilization, on mycorrhizal symbiosis were studied in a field experiment established in 1986. In 1987 and 1989, there were no significant effects of these management practices on mycorrhizal fungus species composition. While 14 and 11 species were observed in 1987 and 1989, respectively, the dominant species in both samplings was *Glomus ambisporum*. Spore numbers were generally not affected by these management practices. However, in 1987 there were significant effects on spore number due to nitrogen addition and a burn .times. mow interaction, but these were not apparent in 1989. In 1989 there was a significant burn .times. nitrogen interaction, with nitrogen fertilization of unburned plots significantly increasing the number of mycorrhizal fungal spores. In winter months total % root colonization, active % root colonization and inoculum potential were low whether or not plants were fertilized. In contrast, in late spring and early summer when plants were actively growing, fertilization reduced total % root colonization, active % root colonization, and inoculum potential in soil. However, nitrogen fertilization was not as inhibitory to the symbiosis as phosphorus fertilization or phosphorus + nitrogen fertilization. The negative effects of nitrogen fertilization on mycorrhizae are probably offset by the pronounced benefit of nitrogen fertilization to plant biomass production.

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874. Effect of season and regrazing on diet quality of burned Florida range.

Long, K. R.; Kalmbacher, R. S.; and Martin, F. G.

Journal of Range Management 39(6): 518-521. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/396/10long.pdf>

Descriptors: cattle/ grazing/ forage/ seasonal variation/ nutritive value/ digestibility/ crude protein/ range management/ prescribed burning/ Florida

This citation is from AGRICOLA.

875. The effect of severe drought and management after drought on the mortality and recovery of semi-arid grassveld.

Danckwerts, J. E. and Stuart Hill, G. C.

Journal of the Grassland Society of Southern Africa 5(4): 218-222. (1988)

NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: increaser decreaser species/ grazing capacity/ Eastern Cape, South Africa

Abstract: The False Thornveld of the Eastern Cape [South Africa] experienced a particularly intense drought. After the drought, recovery was particularly sensitive to the post-drought management treatment applied. Veld that was grazed immediately after the drought recovered far more slowly than veld that was rested. This effect was still evident three years later, illustrating the considerable importance of resting semi-arid grassveld after a drought. Increaser I grass species present were apparently more capable of surviving drought than the Decreaser species, which in turn were more stable than the Increaser II species. Their ability to recover after the drought followed an opposite trend. On this basis, the desirability of Decreaser dominated veld, in situations that are likely to be poorly managed, is questioned.

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876. Effect of stocking rate and rainfall on rangeland dynamics and cattle performance in a semi-arid savanna, South Africa.

Fynn, R. W. S. and O'connor, T. G.

Journal of Applied Ecology 37(3): 491-507. (2000)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: botanical composition/ cattle performance/ grazing effects/ habitat degradation/ herbaceous production/ live weight gain/ non equilibrium behavior/ plant livestock relations/ primary production/ rainfall/ rangeland dynamics/ rotational grazing system/ semi arid savanna/ state and transition model/ stocking rate/ temporal variations

Abstract: 1. In order to examine the emerging paradigm of non-equilibrium behaviour of plant-livestock relations in semi-arid rangeland, the effect of stocking rate, rainfall and their interaction on changes in botanical composition, primary production and live weight gain per animal and per hectare, was studied in a semi-arid African savanna. The objective was to evaluate the relative influence of rainfall and grazing on animal and vegetation dynamics in a temporally varying environment. 2. Two adjacent trials, with different starting conditions of rangeland (good vs. poor) and each of three stocking rates replicated twice, were established in 1986 and maintained for 10 years. A simple rotational grazing system using Brahman weaners was employed. 3. Although changes in botanical composition were strongly influenced by rainfall variability, with a dramatic compositional shift induced by the 1991-92 drought, stocking rate had an additional effect over time in the paddocks on sloping land, particularly on the site which started in good condition. High rainfall and light grazing promoted tufted perennial grasses (*Themeda triandra*, *Digitaria argyrograpta*, *Cymbopogon excavatus*, *Sporobolus ioclados*); heavy grazing and low rainfall promoted some annuals and weakly tufted perennial grasses (*Urochloa mosambicensis*, *Sporobolus nitens*); while other annuals (*Aristida adscensionis*, *Enneapogon cenchroides*) were favoured by heavy grazing and high

rainfall. Patterns of compositional change supported a state-and-transition model. 4. Rainfall had the most marked effect on variability in herbaceous production. Long-term heavy grazing on sloping land resulted in a decline in herbaceous production in both trials. The depletion of herbaceous biomass in a paddock when grazed heavily was more pronounced if botanical composition had changed as a result of drought and grazing. 5. Long-term heavy grazing did not reduce cattle performance (gain animal⁻¹ and gain ha⁻¹). However, during drought cattle performance was worse at high stocking rates on poor condition rangeland than on good condition rangeland. Rainfall was a better predictor of cattle performance than herbaceous biomass and accounted for far more of the variance in gain per animal than did stocking rate. Cattle performance had a curvilinear relationship with rainfall, indicating that a rainfall year of 680 mm is optimal for cattle production in this region. 6. The notion that semi-arid African savannas are non-equilibrium systems in which rainfall overrides grazing was contradicted. Stocking rate determined the requirement of supplementary feeding and influenced gain ha⁻¹ on poor condition rangeland during drought years. In addition, herbaceous productivity was linked to herbaceous composition, which was linked to stocking rate. 7. Key implications for management are (i) the inequality of different parts of the landscape in supporting livestock and in their sensitivity to grazing, slopes being more easily degraded than bottomland; and (ii) the pronounced changes that grazing can induce in semi-arid savanna during and subsequent to drought years. Opportunistic management is a prerequisite for sustained utilization of semi-arid African savanna.

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877. Effect of vertebrate grazing on plant and insect community structure.

Rambo, J. L. and Faeth, S. H.

Conservation Biology 13(5): 1047-1054. (1999)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Abstract: We compared species diversity of plants and insects among grazed and ungrazed areas of Ponderosa pine-grassland communities in Arizona. Plant species richness was higher in two of three grassland communities that were grazed by native elk and deer and domestic cattle than in ungrazed areas inside a series of three large (approximately 40-ha) grazing exclosures. Similarly, plant species richness was higher in grazed areas relative to ungrazed areas at one of two series of smaller (approximately 25-m²) and short-term exclosure sites. Evenness of plant distribution, however, was greater inside ungrazed long-term exclosures but was reduced inside ungrazed short-term exclosures relative to grazed areas. Relative abundances of forbs, grasses, trees, and shrubs, and native and introduced plants did not differ between the long- and short-term grazing exclosures and their grazed counterparts. Relative abundances of some plant species changed when grazers were excluded, however. In contrast, insect species richness was not different between grazed and ungrazed habitats, although insect abundance increased 4- to 10-fold in ungrazed vegetation. Our results suggest that vertebrate grazing may increase plant richness, even in nutrient-poor, semi-arid grasslands, but may decrease insect abundances.

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878. Effects of 20 years of grazing exclusion in an area of the Queen Elizabeth National Park, Uganda.

Lenzi Grillini, Carlo R.; Viskanic, Paolo; and Mapesa, Moses

African Journal of Ecology 34(4): 333-341. (1996)

NAL Call #: 409.6 Ea7; ISSN: 0141-6707

Descriptors: biodiversity/ grazing exclusion/ monitoring/ Queen Elizabeth National Park/ terrestrial ecology

Abstract: The floristic and structural changes resulting from the long-term exclusion of large herbivores from an experimental area set up in 1971 have been analysed, comparing it to two plots in the surrounding grazed and trampled area. The vegetation of the area is grassland with thicket clumps, with *Sporobolus pyramidalis* P. Beauv. dominating the grassland and *Capparis tomentosa* Lam. dominating the thicket layer. The survey showed that long-term exclusion of herbivores results in: (i) higher density and cover in the grass and thicket layer, (ii) lower biodiversity in the grass layer and in the isolated shrubs, (iii) higher root biomass, probably due to the absence of trampling. Despite the difference in area, no difference was noted between the biodiversity of the thicket clumps of the ungrazed area and the grazed and trampled plots.

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879. Effects of bison grazing, fire, and topography on floristic diversity in tallgrass prairie.

Hartnett, D. C.; Hickman, K. R.; and Walter, L. E.

Journal of Range Management 49(5): 413-420. (1996)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1996/495/413-420_hartnett.pdf

Descriptors: prairies/ plant communities/ biodiversity/ botanical composition/ bison/ grazing/ topography/ frequency/ fires/ Kansas

Abstract: Grazed and ungrazed sites subjected to different fire frequencies were sampled on the Konza Prairie Research Natural Area in northeast Kansas after 4 years of bison grazing (1987-1991). The objective was to study effects of bison grazing on plant species composition and diversity components (plant species richness, equitability, and spatial heterogeneity) in sites of contrasting fire frequency. Cover and frequency of cool-season graminoids (e.g. *Poa pratensis* L., *Agropyron smithii* Rydb., *Carex* spp.) and some forbes (e.g. *Aster ericoides* [A. Gray] Howell, and *Oxalis stricta* L.) were consistently higher in sites grazed by bison than in ungrazed exclosures, whereas the dominant warm-season grasses (*Andropogon gerardii* Vitman, *Sorghastrum nutans* [L.] Nash, *Panicum virgatum* L., *Schizachyrium scoparium* [Michx.] Nash) and other forbs (e.g. *Solidago missouriensis* Nutt.) decreased in response to bison. Plant species diversity (H') and spatial heterogeneity in all areas sampled were significantly increased by bison. Increased heterogeneity and mean species richness in grazed prairie (40 species per sample site) compared to ungrazed prairie (29 species per site) were likely a result of greater microsite diversity generated by bison, whereas preferential grazing of the dominant grasses and concomitant increases in subordinate species resulted in an increase in equitability of species abundances. Species/area relationships indicated greater effects of bison on plant species richness with increasing sample area. Increases in plant diversity components associated with bison grazing were generally greater in annually burned than in 4-year burned sites. Effects of

ungulate grazers on floristic diversity have important implications given recent evidence that plant species diversity and the compositional and production stability of grassland plant communities are positively related. This citation is from AGRICOLA.

880. Effects of burning and grazing on a coastal California grassland.

Hatch, Daphne A.; Bartolome, James W.; Fehmi, Jeffrey S.; and Hillyard, Deborah S.

Restoration Ecology 7(4): 376-381. (1999)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: coastal grassland/ fall burning/ foliar cover/ grazing exclusion/ management strategies/ rainfall patterns/ slope position/ species composition

Abstract: We tested the effects of fall burning and protection from livestock grazing as management to enhance native grasses on a coastal grassland in central California. Plants from the Mediterranean, introduced beginning in the late 1700s, have invaded and now dominate most of California's grasslands. Coastal grasslands are generally less degraded than those inland and have higher potential for restoration and conservation. Productivity of the experimental plots varied annually and declined over the course of the study because of rainfall patterns. Foliar cover of the native *Danthonia californica* (California oatgrass) increased more under grazing than grazing exclusion and did not respond to burning. Two other natives, *Nassella pulchra* (purple needlegrass) and *Nassella lepida* (foothill needlegrass), responded variably to treatments. The response of *N. pulchra* differed from that reported on more inland sites in California. Restoring these grasslands is complicated by differing responses of target species to protection from grazing and burning. The current practice of managing to enhance single species of native plants (e.g., *N. pulchra*) may be detrimental to other equally important native species.

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881. Effects of cattle grazing on blue oak seedling damage and survival.

Hall, L. M.; George, M. R.; McCreary, D. D.; and Adams, T. E.

Journal of Range Management 45(5): 503-506. (1992)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1992/455/17hall.pdf>

Descriptors: *Quercus douglasii*/ seedlings/ cattle/ stocking rate/ grazing intensity/ seasonal variation/ winter/ spring/ summer/ crop damage/ range management/ woodlands/ grazing/ California

Abstract: Cattle grazing has been suggested as a principal cause for poor oak recruitment in California's hardwood rangelands. This study evaluated the effects of stock density and season of grazing on blue oak (*Quercus douglasii* H. & A.) establishment. In December 1989, seven hundred and twenty blue oak seedlings were planted on 3-m centers in 30 plots in 3 annual grassland pastures at the Sierra Foothill Research and Extension Center east of Marysville, Calif. The treatments consisted of 3 seasons X 3 stock densities plus 1 nongrazed control. During January, April, and July of 1990, steers and heifers (mean = 318 kg) were allowed to graze 1 plot per week at low, medium, and high stock densities (2.5, 7.5, and 15.0 head/ha, respectively). Control plots were used to monitor wildlife browsing. One half of all seedling sites received an

application of glyphosate prior to transplanting to eliminate grass competition. Browsing and trampling damage were estimated at the end of each treatment. Total damage (sum of browsing and trampling damage), browsing damage, trampling damage, and survival to April 1991 were significantly different for the 9 season and stock density treatments ($p < 0.05$). Spring and summer grazing tended to be most damaging and resulted in the lowest survival rates. Within each season total damage increased with stock density but survival did not change significantly. Weed control around oak seedlings had no apparent effect on total damage or survival. There were significant differences in browsing damage between seasons but not between control and grazed plots within seasons ($p < 0.05$). Survival in ungrazed plots was not significantly different ($p < 0.05$) from the spring and summer grazed plots. Consequently, the contribution of wildlife to reduced blue oak seedling survival in grazed oak woodlands should not be underestimated.

This citation is from AGRICOLA.

882. Effects of cattle grazing on diversity in ephemeral wetlands.

Marty, Jaymee T.

Conservation Biology 19(5): 1626-1632. (2005)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: species diversity/ grazing/ feeding behaviour/ introduced species/ ranching/ endemic species/ wetlands/ life cycle/ nature conservation/ biodiversity/ rare species/ environmental impact/ aquatic plants/ species richness/ conservation/ USA, California, Central Valley/ USA, California

Abstract: Cattle are usually thought of as a threat to biodiversity. In regions threatened by exotic species invasion and lacking native wild grazers, however, cattle may produce the type of disturbance that helps maintain diverse communities. Across 72 vernal pools, I examined the effect of different grazing treatments (ungrazed, continuously grazed, wet-season grazed and dry-season grazed) on vernal-pool plant and aquatic faunal diversity in the Central Valley of California. After 3 years of treatment, ungrazed pools had 88% higher cover of exotic annual grasses and 47% lower relative cover of native species than pools grazed at historical levels (continuously grazed). Species richness of native plants declined by 25% and aquatic invertebrate richness was 28% lower in the ungrazed compared with the continuously grazed treatments. Release from grazing reduced pool inundation period by 50 to 80%, making it difficult for some vernal-pool endemic species to complete their life cycle. My results show that one should not assume livestock and ranching operations are necessarily damaging to native communities. In my central California study site, grazing helped maintain native plant and aquatic diversity in vernal pools.

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883. Effects of cattle grazing on early postfire regeneration of matorral in northwest Patagonia, Argentina.

Raffaele, Estela and Veblen, Thomas T.

Natural Areas Journal 21(3): 243-249. (2001)

NAL Call #: QH76.N37; ISSN: 0885-8608

Descriptors: Nahuel Huapi National Park/ cattle grazing/ early postfire regeneration/ facilitative ecosystem

interactions/ matorral [shrubland]/ native plant biodiversity/ species richness

Abstract: In the National Reserve sector of Nahuel Huapi National Park, southwestern Argentina, livestock are potential threats to native plant biodiversity and may prevent postfire recovery of shrublands. Effects of cattle grazing were examined in a recently burned shrubland (matorral) by installing livestock enclosures and permanent plots and remeasuring vegetation over a 3-year period. Percentage cover of all vascular plant species, and maximum heights of all shrub species, were recorded in ten 25-mX25-m plots from late summer of 1995 to 1997. Five of the plots were fenced and five were left accessible to low-intensity browsing and grazing by cattle. A substantial decline in total species richness, especially shrub species, was attributed to grazing. Under this relatively low level of cattle grazing pressure, frequency and cover of common shrubs and trees were significantly reduced. In contrast, height growth of shrubs and trees was not significantly affected. Facilitative interactions (e.g., nurse effects of shrubs on the vegetative reproduction of other plants) are important in these shrublands. Consequently, an initially slight reduction in abundance of key shrub species creates the potential for more severe long-term reductions in biodiversity.

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884. Effects of cattle grazing on mountain meadows in Idaho.

Leege, T. A.; Herman, D. J.; and Zamora, B.

Journal of Range Management 34(4): 324-328. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/344/16leeg.pdf>

Descriptors: Idaho

This citation is from AGRICOLA.

885. Effects of cattle grazing on North American arid ecosystems: A quantitative review.

Jones, Allison

Western North American Naturalist 60(2): 155-164. (2000)

NAL Call #: QH1 .G7; ISSN: 1527-0904

Descriptors: meta analysis: analytical method/ arid ecosystems/ cattle grazing/ ecosystem integrity/ environmental impact/ litter biomass/ rangeland conservation/ soil bulk density/ species diversity/ species richness/ vegetative cover/ xeric environment

Abstract: A quantitative review was conducted of the effects of cattle grazing in and systems on 16 response variables ranging from soil bulk density to total vegetative cover to rodent species diversity. Various studies from North American arid environments that used similar measures for assessing grazing effects on the same response variables were used for the review; each study was assigned to serve as a single data point in paired comparisons of grazed versus ungrazed sites. All analyses tested the 1-tailed null hypothesis that grazing has no effect on the measured variable. Eleven of 16 analyses (69%) revealed significant detrimental effects of cattle grazing, suggesting that cattle can have a negative impact on North American xeric ecosystems. Soil-related variables were most negatively impacted by grazing (3 of 4 categories tested were significantly impacted), followed by litter cover and biomass (2 of 2 categories tested), and rodent diversity and richness (2 of 2 categories tested). Vegetative variables showed more variability in terms of quantifiable

grazing effects, with 4 of 8 categories testing significantly. Overall, these findings could shed light on which suites of variables may be effectively used by land managers to measure ecosystem integrity and rangeland health in grazed systems.

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886. The effects of cattle grazing on tall-herb fen vegetation and molluscs.

Ausden, M.; Hall, M.; Pearson, P.; and Strudwick, T. *Biological Conservation* 122(2): 317-326. (2005)
 NAL Call #: S900.B5; ISSN: 0006-3207
 Descriptors: grazing/ vegetation patterns/ wetlands/ species richness/ marshes/ aquatic plants/ light effects/ abiotic factors/ population density/ environmental impact/ ecosystem disturbance/ interspecific relationships/ seasonal variations/ species diversity/ Phragmites australis/ Glyceria maxima/ Vertigo moulinsiana/ Carex/ Phragmites
 Abstract: The effects of light year-round cattle grazing on tall-herb fen vegetation and wetland molluscs were compared to the effects of non-intervention over a period of four years using grazing exclosures. The distribution of cattle within the area of fen was investigated by plotting the position of the herd at 3-4 day intervals throughout the year. Cattle distributed themselves randomly throughout the fen in spring, autumn and winter, but showed a more aggregated distribution in summer. Grazing reduced the biomass of Phragmites australis and increased stem densities of Glyceria maxima, resulting in a shift of dominance from Phragmites to Glyceria. Plant species-richness was also significantly higher in areas open to grazing. Grazing decreased total densities of molluscs and substantially reduced densities of the rare snail Vertigo moulinsiana. V. moulinsiana was particularly associated with areas of fen that had a high water table and high biomass of ungrazed Carex riparia. However, because of the patchy nature of the grazing, V. moulinsiana survived at reasonably high densities in patches of ungrazed vegetation within the grazing unit.

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887. Effects of cattle grazing systems on willow-dominated plant associations in central Oregon.

Kovalchik, B. L. and Elmore, W.
 In: Proceedings: Symposium on Ecology and Management of Riparian Shrub Communities. (Held 29 May 1991-31 May 1991 at Sun Valley, Idaho.) Clary, Warren P.; McArthur, E. Durant; Bedunah, Don; and Wambolt, Carl L. (eds.); Vol. 289.
 Ogden, Utah: US Department of Agriculture, Forest Service, Intermountain Research Station; pp. 111-119; 1992.
 NAL Call #: aSD11.A48
 Descriptors: plant communities/ Salix/ grazing/ cattle/ environmental impact/ browsing/ range management/ riparian buffers/ Oregon
 This citation is from AGRICOLA.

888. Effects of controlled grazing on a degraded dwarf shrub, annual grass semidesert, vegetation type of northwestern Kenya.

Oba, G.
Land Degradation & Rehabilitation 3(4): 199-213. (1992)
 NAL Call #: S622.L26; ISSN: 0898-5812
 Descriptors: range management/ Indigofera/ shrubs/

rangelands/ semiarid zones/ species diversity/ land management/ degradation/ canopy/ botanical composition/ volume/ plant density/ grazing/ plant litter/ Kenya
 This citation is from AGRICOLA.

889. The effects of controlled grazing on phytomass dynamics of the dwarf shrub Indigofera spinosa in arid Kenya.

Oba, Gufu
Acta Oecologica 16(1): 31-54. (1995)
 NAL Call #: QH540.A27; ISSN: 1146-609X
 Descriptors: herbivory/ management/ pastoralism/ production/ standing crop
 Abstract: Conventional range rehabilitation methods use controlled grazing, followed by assessments of either species composition, cover or phytomass dynamics. We compared effects of controlled and free grazing on the dynamics of live (current year's and preceding years' crops), standing dead and litter fraction of the dwarf shrub Indigofera spinosa (Forsk.) Matthew between 1986 and 1990, on arid range of North-West Kenya. Except for standing dead fraction and litter mass, live phytomass fractions varied significantly between growth and dormancy months in the two treatments. Generally, phytomass fractions exhibited disappearance in grazed plots, while it was accumulated in control plots. The control, however, achieved greater phytomass turnover (50.1 +/- 15.8% Yr-1) than grazed plots (34.4 +/- 6.0% Yr-1). The results showed that browsing when combined with declining rainfall, increased depreciation of forage yield, while above-average rainfall enhanced greater phytomass production. Given the rapid recovery potential by the shrub, declining trends of live fractions in grazed plots were unlikely to be permanent but fluctuate between periods of favourable rainfall and drought. The relationship between total monthly rainfall, cumulative rainfall of the current and the preceding months and the current year's crop, respectively, was explained by correlation coefficient (r) of 0.23-0.30 in control plots and 0.43-0.65 in grazed plots (p lt 0.05). Daily green dry matter productivity and rainfall use efficiency (RUE) of I. spinosa improved when rain storm events were closely sequenced and spread over growth months. On this arid range, dwarf shrub litter production showed constancy, while standing dead fraction increased by about 900% in control plots and declined by 40% in grazed. Accumulation of standing dead phytomass fraction in control plots portrayed a deteriorating forage condition. Given that I. spinosa is highly adapted to herbivory, deferral of over-browsed shrubs should be limited to no more than 1-2 growth seasons. The paper discusses management implications of the findings.
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890. The effects of controlled sheep grazing on the dynamics of upland Agrostis-Festuca grassland.

Hulme, P. D.; Pakeman, R. J.; Torvell, L.; Fisher, J. M.; and Gordon, I. J.
Journal of Applied Ecology 36(6): 886-900. (1999)
 NAL Call #: 410 J828; ISSN: 0021-8901
 Descriptors: agrostis festuca grassland: acid grassland, habitat/ controlled grazing/ initial composition/ plant community/ species composition/ sustainable dynamics/ sward height
 Abstract: 1. Agrostis capillaris-Festuca ovina-dominated communities are widespread in the uplands of Great Britain. They are agriculturally productive but little is known

about how to manage this community for specific goals. Vegetation trajectories were examined in this plant community under different sheep grazing management regimes at two sites in Scotland. One site had a substantial presence of moorland species, the other was characterized by a more productive vegetation. Management consisted of maintaining sward heights of 3, 4.5 or 6 cm during the growing season, or complete exclusion of grazing stock. 2. Changes in species composition were small over the 7 years of the experiment. Few species invaded or were lost during the course of the study. The observed changes were largely as a result of shifts in abundance of the dominant species. 3. Maintenance of sward height at low levels (3 or 4.5 cm.) during the growing season resulted in the spread of *Nardus stricta* where present. Where *N. stricta* was absent, the sward developed a higher content of mosses, specifically *Hypnum jutlandicum* and *Rhytidiadelphus squarrosus*. 4. Removal of grazing resulted in an increase of cover of grazing-intolerant species, such as *Deschampsia flexuosa* and *Molinia caerulea*, and in the cover of dwarf shrub species where present. 5. The two sites differed in the treatment that resulted in the smallest change in species composition. At the more productive site, maintenance of the sward at 4.5 cm resulted in the smallest overall change in species composition. At the less productive site, grazing the sward to 6 cm resulted in the smallest shift in vegetation composition. Grazing at this height appeared to prevent the spread of both *M. caerulea* and *N. stricta*. 6. The study demonstrates that sustainable grazing regimes for upland *Agrostis-Festuca* grasslands need to take into account both the initial composition of the vegetation, specifically the presence of species capable of replacing *A. capillaris* and *F. ovina* and of achieving dominance, and the overall productivity of the site.
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891. Effects of cutting and grazing on Andean treeline vegetation.

Kok, Kasper; Vewej, Pita A.; and Beukema, Hendrien
In: Biodiversity and conservation of neotropical montane forests/ Churchill, Steven P.
New York: New York Botanical Garden, 1995; pp. 527-539.
Notes: Meeting Information: Symposium, New York, New York, USA; June 21-26, 1993; ISBN 0893274003
NAL Call #: QK241.B56 1995
Descriptors: book chapter/ central colombian cordillera/ conservation/ disappearing species/ meeting paper/ regenerating forest/ treeline lowering
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892. The effects of different rotational grazing intensities on the soil, grassland and sheep productions in the northern Tianshan in China.

Li, Jianlong
Archivos de Zootecnia 46(176): 301-310. (1997)
NAL Call #: 49 AR22; *ISSN:* 0004-0592
Descriptors: botanical composition/ carrying capacity/ grassland herbage yield/ grazing intensity/ rotational grazing/ soil compaction/ spring autumn pasture/ wool production
Abstract: The study on the different grazing intensity experiments was conducted on Ziniquan ranch, Shihezi city in Xinjiang province (China) in spring-autumn seasons from 1986 to 1990. The results showed that the soil compaction (0-30 cm), herbage yields, grazing rates, regrowth herbage

yields and sheep productions were affected significantly by the different grazing intensities ($p < 0.05$). From eight side comparisons in this paper, it was considered that the moderate grazing (herbage utilizing rate=50 percent) was the best and the adaptive grazing intensity in 4 treatments, resulted from increasing grassland herbage yields (60 percent higher than overgrazing) and improving grassland botanical composition (3 grass better yields/gross grass yields) in 26.3 percent, and conducted to raising sheep weights (119.5 g/day sheep) and wool productions (5.4 kg/sheep). In the experimental conditions, the carrying capacity (6 sheep/ha) of rotational grazing in 4 regions and 2 seasons was twice that of grazing uncontrolled on large area pasture or that observed in normal grazing conditions (3 sheep/ha).

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893. Effects of differential livestock use on key plant species and rodent populations within selected *Oryzopsis hymenoides/Hilaria jamesii* communities of Glen Canyon National Recreation Area.

Bich, Brian S.; Butler, Jack L.; and Schmidt, Cheryl A.
Southwestern Naturalist 40(3): 281-287. (1995)
NAL Call #: 409.6 SO8; *ISSN:* 0038-4909
Descriptors: grazing
Abstract: Four sites that varied with respect to grazing history were studied during 1990 and 1991 on an isolated 8,000 ha peninsula in Glen Canyon National Recreation Area. Density and basal area of *Oryzopsis hymenoides* decreased with increasing grazing intensity while density and foliar cover of *Gutierrezia sarothrae* increased on grazed sites. *Perognathus longimembris* was the most abundant rodent species trapped on all sampled sites and demonstrated a 50% decrease in abundance at the heavily grazed site compared to the nongrazed site. *Peromyscus maniculatus* was the second most abundant rodent species recorded and increased with increasing grazing intensity.
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894. Effects of elevation, slope position and livestock exclusion on microfungi isolated from soils of Mediterranean grasslands.

Maggi, O.; Persiani, A. M.; Casado, M. A.; and Pineda, F. D.
Mycologia 97(5): 984-995. (2005)
NAL Call #: 450 M99; *ISSN:* 0027-5514
Descriptors: elevation/ fungal communities/ herbivory/ soil fungi/ Spain
Abstract: The fungal communities of grassland soils in Spain from four sites at different elevations were studied. Each site contained grazed and fenced ungrazed plots. These plots were situated in two slope positions (upper and lower zones). The ungrazed plots, fenced off 6 y before the sampling, were part of a study of global change that simulates conditions of rural abandonment, which is widespread in Iberian countries, since Spain joined the European Union. We analyzed the structure of the soil fungi communities and its relationship with herbaceous vegetation. The distribution of 207 taxa of fungi revealed that the elevation was the main factor of fungal variability; the effect of grazing and slope position were associated with less variability. Although a halt in grazing resulted in the accumulation of standing plants and plant litter in these ecosystems, it had relatively little effect on soil microfungi

and appeared to be related mainly to growing conditions affected by that accumulation. © 2005 by The Mycological Society of America.

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895. The effects of elk and cattle foraging on the vegetation, birds, and small mammals of the Bridge Creek Wildlife Area, Oregon.

Moser, B. W. and Witmer, G. W.

International Biodeterioration and Biodegradation 45(3-4): 151-157. (2000)

NAL Call #: QH301.I54; ISSN: 0964-8305

Abstract: High densities of elk (*Cervus elaphus*), especially when combined with cattle (*Bos taurus*), may adversely affect local reforestation efforts and reduce forage availability. Few studies, however, have assessed the potential impacts of high densities of elk, combined with cattle, on biodiversity. We compared vegetation, bird, and small mammal diversity of three elk and cattle exclosures (ungrazed sites) to three grazed sites in the Blue Mountains of eastern Oregon. Shrub species richness was greater on ungrazed than grazed sites ($P = 0.04$). We found no differences in herbaceous vegetative cover, biomass, species richness, or diversity, bird abundance, species richness, or diversity between grazed and ungrazed sites. Small mammal abundance ($P \leq 0.01$), species richness ($P \leq 0.01$), and diversity ($P \leq 0.03$) were greater on ungrazed than grazed sites. In this study, foraging by elk and cattle appears to be reducing shrub and small mammal biodiversity. (C) 2000 Published by Elsevier Science Ltd. © 2006 Elsevier B.V. All rights reserved.

896. Effects of excluding grazing animals from grassland on sugar limestone in Teesdale, England.

Elkington, T. T.

Biological Conservation 20(1): 25-35. (1981)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: *Oryctolagus cuniculus*/ *Ovis aries*/ European rabbit/ domestic sheep/ vegetation/ food/ geobotany/ British Isles

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897. Effects of fire and grazing on an arid grassland ecosystem.

Valone, Thomas J.; Nordell, Shawn E.; and Ernest, S. K. Morgan

Southwestern Naturalist 47(4): 557-565. (2002)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ community structure/ population dynamics/ habitat/ terrestrial habitat/ abiotic factors/ physical factors/ land and freshwater zones/ Nearctic Region/ North America/ USA/ Rodentia: farming and agriculture/ livestock grazing/ species diversity/ population size/ fire and livestock grazing effects/ grassland/ fire/ New Mexico/ Hidalgo County/ Animas Valley/ fire and livestock grazing effects on abundance and diversity/ arid grassland/ Rodentia/ Mammalia/ chordates/ mammals/ vertebrates

Abstract: We examined short-term responses of grasses, shrubs, and rodents on experimental plots to determine how manipulations of livestock grazing and prescribed fire affect individual species and community structure in a shrub-invaded arid grassland. Two grasses and *Gutierrezia sarothrae* were found in lower abundance on burned plots

in the growing season after plots burned; all *Prosopis glandulosa* survived the fire. Total rodent captures and the number of *Dipodomys spectabilis* did not differ among treatments. No significant interaction between burning and grazing was observed. Fire seems to have few short-term negative effects on species in this system.

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898. Effects of fire, grazing, and the presence of shrubs on Chihuahuan desert grasslands.

Drewa, Paul B. and Havstad, Kris M.

Journal of Arid Environments 48(4): 429-443. (2001)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: Chihuahuan desert grasslands: habitat/ drought conditions/ grazing/ perennial forb cover/ perennial grass cover/ precipitation/ prescribed fires/ species diversity

Abstract: Responses of herbaceous and suffrutescent species to fire, grazing, and presence of *Prosopis glandulosa* were examined in a Chihuahuan desert grassland in south-central New Mexico. Treatments were assigned randomly to eight 12X8 m plots within each of two blocks. Following fires in June 1995, unfenced plots were exposed to livestock grazing over 4 years. Plots were established that either included or excluded *P. glandulosa*. Perennial grass cover, primarily *Bouteloua eriopoda*, decreased by 13% in burned plots but increased 5% in unburned areas. Conversely, perennial forb cover was 4% greater after fire. Perennial grass frequency decreased 30% more and perennial forb frequency increased 10% more following burning. Further, increases in evenness after fire resulted in a 225% increase in species diversity. Grazing also resulted in a decrease in perennial grass cover while frequency decreased 22% more in grazed than ungrazed plots. Only frequency and not cover of perennial forbs and annual grasses increased more following grazing. Presence of *P. glandulosa* had no differential effect on responses of non-shrub species. Fires were conducted during near drought conditions while grazing occurred during years of precipitation equivalent to the long-term average. Precipitation immediately following fire may be critical for recovery of *B. eriopoda*-dominated desert grasslands; relationships between fire and post-fire precipitation patterns require future investigation. © The Thomson Corporation

899. The effects of flooding and livestock on post-dispersal seed predation in river red gum habitats.

Meeson, N.; Robertson, A. I.; and Jansen, A.

Journal of Applied Ecology 39(2): 247-258. (2002)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: flood histories/ flooding/ floodplain habitat/ floodplain habitats/ forested floodplain/ grazing/ livestock/ livestock management histories/ livestock management regimes/ post dispersal seed predation/ recruitment/ river regulation/ seasonality/ seed predation/ seed removal/ water extraction/ winter seed predation

Abstract: 1. Rates of seed predation are influenced by conditions that alter seed supply and the activity of seed predators. In southern Australia the potential seed supply for the dominant floodplain tree species, the river red gum *Eucalyptus camaldulensis*, has been reduced through forest clearing to support grazing by introduced livestock. River regulation and water extraction have reduced the frequency of flooding and thus the conditions that promote seed germination on floodplains. To determine if poor

recruitment of river red gums could be caused by low seed supply, as a result of post-dispersal seed predation, we used field experiments and observations to investigate how post-dispersal predation on seeds of *E. camaldulensis* was affected by flooding, livestock management and their interaction. 2. Seed predation was measured before and after different flood treatments (0.5 m depth; short flood of 24 h, long flood of 30 days). Flooding of this kind (return frequency of once per year) did not have any significant effect on rates of seed removal by seed predators. 3. Rates of seed predation in floodplain habitats under widespread livestock management regimes changed seasonally. In all seasons seed predation was lowest at sites grazed by sheep. In winter seed predation was highest at ungrazed sites. In spring and summer seed predation was highest at sites grazed by cattle. Ant communities differed between forested and cleared habitats and seed-eating ant species were most abundant in cleared sites grazed by cattle. 4. Rates of seed predation in forested floodplain sites with different flood histories differed among sites with different livestock management histories. The impact of cattle exclusion on seed predation rates increased as the period since flooding increased. 5. Cattle grazing is widespread on the floodplains of rivers across the southern Murray-Darling Basin, and tree densities and hence seed supplies are low. In this situation small floods may not result in significant recruitment to river red gum populations because seed predation may reduce seed supply before and following flooding. Decreases in the frequency of flooding owing to river regulation and water extraction are likely to have exacerbated the influence of livestock on seed supply and thus reduced potential recruitment even further. 6. Efforts to rehabilitate large floodplain rivers based solely on the return of more natural flow regimes may fail if the effects of factors such as livestock grazing are not managed concurrently. © The Thomson Corporation

900. The effects of grassland management on nitrogen losses from grazed swards through ammonia volatilization; the relationship to excretal N returns from cattle.

Jarvis, S. C.; Hatch, D. J.; and Roberts, D. H.
Journal of Agricultural Science 112(pt.2): 205-216. (1989)
 NAL Call #: 10 J822; ISSN: 0021-8596
Descriptors: biogeochemical cycles/ nitrogen fertilizers/ losses from soil/ cattle/ excreta/ range management/ grazing/ ammonia/ England
 This citation is from AGRICOLA.

901. The effects of grazing and burning on soil and plant nutrient concentrations in Colombian paramo grasslands.

Hofstede, Robert G. M.
Plant and Soil 173(1): 111-132. (1995)
 NAL Call #: 450 P696; ISSN: 0032-079X
Descriptors: crop industry/ andosol/ litter decomposition/ minerals/ phosphorus fixation/ tropical alpine/ tussock grass/ vegetation structure
Abstract: The impact of extensive livestock farming on the physical and chemical characteristics of the volcanic soils and on the nutrient status of green plant tissues of neotropical alpine grasslands (paramo) is studied. Soil and plant samples were taken over a one-year period at five sites with different agricultural (grazing and burning) management. In the undisturbed paramo ecosystem, soil

moisture (50-250%) and organic matter content are high (7-27%) and decomposition (11-35% yr⁻¹) and element concentrations are low. Low temperatures (max 10 degree C) and phosphorus fixation by the soil (5 mg P g⁻¹ soil) determine the low mineralization and turn-over rates. Multivariate analysis of laboratory results indicates that the season of sampling and the agricultural practice are the most important explanatory factors for variation of soil characteristics. After long-term heavy grazing, soils have a higher bulk density and a lower moisture content. The outcome of a litterbag experiment confirms the hypothesis of higher decomposition rates at grazed sites. In the intermediate (wet-dry) season, conditions were somewhat better for plant growth but the system remained nutrient limited. Surprisingly, no relation between soil density, moisture or carbon content and concentrations of available nutrients in the soil is found. This is supported by the rather uniform nutrient concentrations in green plant tissue among the sites. It is concluded therefore that the effect of burning and grazing on paramo soils is principally restricted to physical characteristics, and that differences in chemical characteristics of the soil do not cause differences in vegetation structure between grazed, burned and undisturbed sites.

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902. Effects of grazing and depth on two wetland plant species.

Blanch, S. J. and Brock, M. A.
Australian Journal of Marine and Freshwater Research 45(8): 1387-1394. (1994)
 NAL Call #: 442.8 Au73; ISSN: 0067-1940.
Notes: Special issue: Plants and processes in wetlands
Descriptors: grazing/ predation/ herbivores/ water depth/ wetlands/ plant populations/ species diversity/ plant growth/ *Myriophyllum variifolium*/ *Eleocharis acuta*/ Australia, New South Wales, Llangothlin Lagoon
Abstract: Wetland plants in Llangothlin Lagoon, northern New South Wales, are subject to grazing and trampling by cattle, sheep and waterbirds and to fluctuating water levels. *Myriophyllum variifolium* J. Hooker, an aquatic dicotyledon with dispersed meristems, exhibited different morphological changes to the emergent monocotyledon *Eleocharis acuta* R. Br. under simulated and natural grazing at different water depths. Responses were principally determined by position and number of meristems. Growth point production (numbers of shoots and branches) increased under light, frequent clipping (25% every 14 or 7 days) in non-submerged plants only. Node production, total plant or shoot length, and above- and below-ground biomass decreased under similar clipping treatments. *E. acuta* did not increase shoot production or above-ground biomass under any clipping treatment, and only for the lightest clipping treatment (clipped once to 7 cm when non-submerged) was no decrease in total shoot length observed. More intense and frequent clipping treatments and submersion to 15 cm prevented both species from replacing lost tissues. Interaction between clipping and submersion occurred in both species, indicating that growth responses are complex. The distribution and abundance of the two species reflect the greater tolerance of *M. variifolium* than *E. acuta* to grazing and inundation. Low intensities of cattle and sheep grazing may be beneficial by increasing species diversity.

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903. Effects of grazing and drought on population dynamics of salt desert shrub species on the Desert Experimental Range, Utah.

Chambers, J. C. and Norton, B. E.

Journal of Arid Environments 24(3): 261-275. (1993)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: grasslands/ deserts/ population dynamics/ drought/ grazing intensity/ salt land/ grazing/ grazing systems/ seasonal-grazing

Abstract: Population dynamics of dominant salt desert shrub species were studied in a drought period (July 1975-Jan. 1978) on pastures which had been grazed by sheep at light or heavy intensity in winter or spring since 1937. Species responses in the drought were more predictable from their life history and physiological traits than from past responses to grazing alone. Heavy or spring grazing increased mortality of *Artemisia spinescens*, a cool-season shrub susceptible to past grazing, and of *Sporobolus cryptandrus* and *Atriplex confertifolia*, a C4 grass and shrub, respectively, that had increased under this grazing regime in the past. Light or winter grazing during this period increased survival and natality of *S. cryptandrus*, and of *Ceratoides* [*Krascheninnikovia*] *lanata*, a shrub that had decreased in density but increased in cover under past grazing. Population turnover rates were generally positive for *A. spinescens*, but were highly negative for *A. confertifolia* in all but the heavy spring grazing treatment. *A. confertifolia* had exhibited high mortality during past droughts. *C. lanata* exhibited little population change reflecting past trends. Generally positive rates of turnover for *S. cryptandrus* and *Oryzopsis hymenoides*, paralleled past trends, except in the spring-heavy treatment which had highly negative turnover rates. In a comparison of grass vs. shrub dominated vegetation types, *C. lanata* had higher mortality in grass dominated plots; *O. hymenoides* had higher mortality in shrub dominated plots. Both *S. cryptandrus* and *O. hymenoides* exhibited low or negative turnover rates for grazed plots within the shrub dominated type. Overall, light to moderate grazing and the removal of livestock before active physiological growth of cool season species had the least negative effects on population dynamics during a 2-year drought period. This grazing regime increased survival or natality of certain species.
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904. Effects of grazing and inundation on pasture quality and seed production in a salt marsh.

Pehrsson, O.

Vegetatio 74(2-3): 113-124. (1988)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: grazing/ species composition/ salt marshes/ population dynamics/ flooding/ aquatic plants/ Sweden/ effects on/ environmental impact/ herbage quality/ seed production/ species composition

Abstract: During a six-year period, changes in the composition of dominant plant species of importance to foraging birds in a salt marsh on the Swedish west coast were followed inside and outside exclosures to document effects of grazing on herbage quality and seed production. Since marshes provide an important habitat for foraging geese and ducks, it was of interest to determine how cattle grazing would affect herbage production in *Agrostis stolonifera* and *Puccinellia maritima* and seed and root-tuber production in *Scirpus maritimus*. Measurements of cover and height in permanent plots revealed that a wetter

weather type favoured *Agrostis*, probably through reduced salinity, at the expense of *Puccinellia*, which was the most favoured food of both cattle and birds. *Agrostis* out-competed *Puccinellia* when grazing pressure was low. Seed production in *Scirpus maritimus* was reduced by cattle grazing, particularly when *Phragmites australis* formed part of the vegetation. In the absence of cattle grazing, both herbage- and seed producing plants were gradually reduced, and *Phragmites* increased.

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905. Effects of grazing Conservation Reserve Program lands in North Dakota on birds, insects, and vegetation.

Kennedy, Carmen L.; Jenks, Jonathan A.; and Higgins, Kenneth F.

Proceedings of the South Dakota Academy of Science 80: 213-226. (2001)

NAL Call #: 500 So82; ISSN: 0096-378X

Descriptors: Aves

Abstract: [unedited] Effects of two grazing systems on nongame birds, insect biomass, and vegetation structure in Conservation Reserve Program (CRP) grasslands were evaluated in North Dakota. Treatments included idle (controls), 3-pasture twice-over deferred rotation grazing, and season-long grazing systems. Twelve species of nongame passerine birds in 1992 and ten species in 1993 used CRP fields. The lark bunting (*Calamospiza melanocorys*), grasshopper sparrow (*Ammodramus savannarum*), red-winged blackbird (*Agelaius phoeniceus*) and brown-headed cowbird (*Molothrus ater*) dominated species composition in 1992 and 1993. CRP pastures under rotational or season-long grazing treatments maintained equal or higher mean male bird densities compared to idle CRP control fields. Mean density of male birds, terrestrial insect biomass and, for the most part, vegetation height, were lower in 1993 than 1992. Results indicated that high insect biomass in pastures with dense cover does not necessarily equate to higher nongame bird use. At moderate stocking rates (~2.1 AUM/ha), our results indicated that grazing of CRP lands could be included in contract terms or in negotiations in any extensions or modifications of future CRP contracts without any significant losses to nongame birds.
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906. Effects of grazing exclusion and reseeding on a former uranium mill site in the Great Basin Desert, Arizona.

Lash, Donald W.; Glenn, Edward P.; Waugh, W. Jody; and Baumgartner, Donald J.

Arid Soil Research and Rehabilitation 13(3): 253-264. (1999)

NAL Call #: S592.17.A73A74; ISSN: 0890-3069

Descriptors: former uranium mill site/ grazing exclusion effect/ remediation program/ reseeding effect/ revegetation

Abstract: Germinable seed in the soil seed bank and vegetation were characterized at a former uranium mill site in the Great Basin desert, Arizona, 10 years after a remediation program was conducted to remove surface contamination and revegetate the site. The objective of the study was to evaluate the effectiveness of reseeding as routinely practiced to revegetate such sites. Three different conditions at the site were evaluated: (1) an area that had been bladed to remove topsoil then reseeded with exotic and native species and fenced to exclude livestock

(ungrazed-bladed-reseeded) (2) a control area inside the fence that had not been bladed or reseeded (ungrazed), and (3) for further comparison, an area outside the fence that was undisturbed by the milling and remediation efforts but has received normal grazing pressure (grazed). Each condition was represented by three plots, from which soil samples and transect data were collected. The diversity of species and total number of viable seeds in the seed bank (top 5 cm of soil) were lowest in the ungrazed-bladed-reseeded plots ($P < 0.05$). These plots also had lower plant cover (15%) than the ungrazed plots (24%) ($P < 0.05$), comparable to the cover on grazed plots (11%), even after 10 years of grazing exclusion. We conclude that at this site the results of topsoil removal and replacement were not effectively remediated by reseeded. Although these methods may be effective in moister climates, more intensive efforts to reintroduce vegetation may be required in desert sites such as this.

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907. Effects of grazing exclusion in alpine grasslands in the Central Alps.

Erschbamer, B.; Moser, C.; and Vorhauser, K.
In: Land use systems in grassland dominated regions. (Held 21 Jun 2004-24 Jun 2004 at Luzern, Switzerland.); pp. 284-286; 2004.

Descriptors: alpine grasslands/ canopy/ ecosystems/ ecotones/ grasslands/ grazing/ plant communities/ seed characteristics/ seed production/ seed weight/ treelines
Abstract: In summer 2000 several grazing exclusion areas were established in Obergurgl and Hochgurgl (Otzal, Tyrol, Austria). The main aim was to establish a long-term project in the alpine zone to monitor changes in alpine grassland ecosystems after grazing cessation. Three exclosures were established on each of three alpine sites (2300 m, 2500 m and 2600 m asl) and one exclosure at the treeline ecotone (1950 m asl), respectively. Within each exclosure, permanent plots of 1 m² were established, and compared with control plots outside each fenced area. Frequency counts were made every growing season from 2000 to 2003. In addition, in 2002 and 2003, flower, fruit and seed production were studied. A higher canopy height and a higher amount of litter was observed in the exclosure plots, compared to the controls. The frequency of the species changed in most of the plots. Some species were positively affected, while others exhibited a lower frequency after four years. The number of seeds and the seed weight of selected species were significantly higher within the exclosures. It can be concluded that the frequency of Poaceae and Cyperaceae increases within the exclosures, whereas mosses and lichens generally decrease. Species-poor alpine grassland communities will result from long-term cessation of grazing.

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908. Effects of grazing exclusion on rangeland vegetation and soils, east central Idaho.

Yeo, Jeffrey J.
Western North American Naturalist 65(1): 91-102. (2005)
NAL Call #: QH1 .G7; ISSN: 1527-0904

Descriptors: brush burning: applied and field techniques/ mechanical brush treatment: applied and field techniques/ ecological stability/ grazing exclusion/ ground cover/ livestock grazing/ plant composition/ sagebrush steppe ecosystem/ screening cover/ semiarid ecosystem/

shadscale rangeland/ soil erosion/ soil flow pattern/ soil movement/ soil pedestal/ species richness/ wildlife restoration

Abstract: Nineteen exclosures on sagebrush steppe and shadscale rangelands, varying in age from 18 to 38 years, were sampled for plant species richness, plant composition, indicators of soil erosion, ground cover, vegetative cover, and herb-low shrub layer screening cover. Features within the exclosures were compared with adjacent sites of the same size that were open to grazing by livestock and wildlife. Species richness typically was slightly greater inside p exclosures than in adjacent grazed sites (median = 2 more species inside exclosures), but the difference was not significant ($P = 0.16$). Similarity of plant community composition between exclosures and adjacent grazed sites ranged from 45% to 82%. Evidences 4 soil movement, soil pedestals, and soil flow patterns were all more pronounced outside exclosures than inside (P ltoreq 0.02), even though many sites were on flat to mild slopes (median slope = 12%). Meta-analysis of the 19 exclosure sites indicated that grazing exclusion resulted in less bare ground cover compared with adjacent grazed sites (P ltoreq 0.05). The effect of grazing exclusion on visible soil surface cryptogams was significant (P ltoreq 0.05), with generally greater cover inside exclosures. Cryptogam cover differences between grazed sites and exclosures tended to increase with the number of years of grazing exclusion ($r = 0.64$, $P = 0.046$). *Pseudoroegneria spicata*, a principal livestock forage, averaged greater basal cover inside exclosures than outside on 4 of 10 sites where it occurred, although no exclosure sites had greater *P. spicata* cover on grazed sites. Meta-analysis of the 10 sites indicated that grazing exclusion resulted in greater *P. spicata* cover compared with adjacent grazed areas (P ltoreq 0.05). *Poa secunda*, a short-growing grass that initiates growth early in the spring and is not important livestock forage, averaged greater basal cover outside exclosures on 5 of 15 sites where it occurred. Meta-analysis of the 15 sites indicated a significant treatment effect (P ltoreq 0.05), with greater *Poa secunda* basal cover outside exclosures. Grazing exclusion resulted in greater screening cover in the herb-low shrub layer (0-0.5 m height; P ltoreq 0.05). These results indicate that despite improved livestock grazing management over the past half century, livestock grazing still can limit the potential of native plant communities in sagebrush steppe ecosystems, and that the health of semiarid ecosystems can improve with livestock exclusion in the absence of other disturbances. A few exclosure sites were similar for the measured parameters, suggesting that these sites were ecologically stable and that exclusion of livestock grazing was not sufficient to move succession toward more pristine conditions, at least within the time periods studied. Managed disturbance such as fire or mechanical brush treatments may be necessary to restore herb productivity on these ecologically stable sites.

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909. Effects of grazing intensity on heathland vegetation and ground beetle assemblages of the uplands of County Antrim, north-east Ireland.

Mcferran, D. M.; Montgomery, W. I.; and Mcadam, J. H. *Biology and Environment* 94B(1): 41-52. (1994); ISSN: 0791-7945

Descriptors: above ground biomass/ botanical composition/ grazing pressure/ individual species cover/ land management/ Scottish blackface sheep/ sward structure/ trapping success

Abstract: Grazing pressures have increased on the uplands of the British Isles. This is particularly evident on the Antrim Plateau of north-east Ireland. The effects of grazing pressure on heathland vegetation and ground beetle assemblages was investigated experimentally. Between June and September in 1988 and 1989, enclosures (0.64 ha) on three types of heathland community - low, medium and high density of *Calluna* - were grazed at one of four intensities equivalent to 0-4.5 Scottish Blackface sheep/ha. The effects of grazing intensity on above-ground biomass, individual species cover, botanical composition, sward structure and associated ground beetle assemblages were assessed using standard methods. At higher grazing intensities, percentage composition of green heather, live Gramineae species, live non-Gramineae species and other dead material declined. Live *Calluna* was reduced by increased grazing intensity once more nutritious species were depleted. Ground beetle assemblages differed with respect to heathland community, grazing intensity and trapping dates. Trapping success of the most abundant species, *Nebria salina*, increased with increasing grazing intensity. The effects of management changes on the ecosystem of the Antrim Plateau are discussed.

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910. Effects of grazing management and environmental factors on native grassland and grassy woodland, Northern Midlands, Tasmania.

Leonard, Steven W. J. and Kirkpatrick, J. B. *Australian Journal of Botany* 52(4): 529-542. (2004) NAL Call #: 450 Au72; ISSN: 0067-1924

Descriptors: grazing management: applied and field techniques/ grassy woodland/ lowland grassland

Abstract: Most remnants of lowland grassland and grassy woodland in Tasmania are grazed by sheep. In some instances, grazed remnants have high conservation value, indicating that grazing and biodiversity conservation are not necessarily conflicting management goals. However, few data exist on the management practices most conducive to maintaining conservation values. The present study examined native grassland and grassy woodland subject to seven different sheep-grazing regimes in the Northern Midlands bioregion of Tasmania and sought to identify the effects of management and environmental factors on vegetation structure and composition. Structural and compositional differences between grassland and woodland, and herbivore scat counts, suggested that grazing disturbance was more intense in grassland than in woodland. Floristic differences within the vegetation appeared to be related to differences in grazing regime. Occurrence of species not commonly observed in grassy vegetation was associated with the resting of pastures in spring, while more intensely grazed sites contained assemblages of species typical of disturbed areas. Exotic

invasion was greatest at sites that were not rested and/or had higher stocking rates, and at more eroded sites. Thus, resting and/or low stocking rates were associated with good condition in the grassland and grassy woodland. The nature of differences in vegetation attributes between woodland and grassland suggests that grazer habitat preference increases the differences between these vegetation types. Relatively minor variation in grazing regime was found to have resulted in distinct floristic outcomes, suggesting that the maintenance of a range of management regimes may be conducive to the maintenance of plant species diversity at a landscape scale.

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911. The effects of grazing management on moorland vegetation: A comparison of farm unit, grazing paddock and plot experiments using a community modelling approach.

Rushton, S. P.; Sanderson, R. A.; Wildig, J.; and Byrne, J. P.

In: *Vegetation management in forestry, amenity and conservation areas: Managing for multiple objectives/ Association of Applied Biologists; Series: Aspects of applied biology* 44.

Warwick: Association of Applied Biologists, 1996; pp. 211-219.

Notes: ISSN: 0265-1491

NAL Call #: QH301.A76 no.44

Descriptors: grazing/ range management

This citation is from AGRICOLA.

912. Effects of grazing management on standing crop dynamics in tallgrass prairie.

Cassels, D. M.; Gillen, R. L.; McCollum, F. T.; Tate, K. W.; and Hodges, M. E.

Journal of Range Management 48(1): 81-84. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/481/081-084_cassels.pdf

Descriptors: grasses/ prairies/ stocking rate/ grazing intensity/ rotational grazing/ rain/ air temperature/ biomass/ forage/ Oklahoma

Abstract: Grazing system and stocking rate effects on forage standing crop of tallgrass prairies in north-central Oklahoma were evaluated from 1989 to 1993. Twelve experimental units, consisting of pastures dominated by big bluestem [*Andropogon gerardi* Vitman], little bluestem [*Schizachyrium scoparium* (Michx. Nash)], indiagrass [*Sorghastrum nutans* (L.) Nash], and switch grass [*Panicum virgatum* L.], were arranged in a completely randomized design with either a short duration rotation or continuous grazing system and stocking rates ranging from 127 kg animal live-weight/ha to 222 kg live-weight/ha. Yearling steers grazed the units from late April to late September. Herbage standing crop was sampled in July and September. Total, live, and dead standing crops did not differ significantly between the 2 grazing systems in July. Total standing crop was significantly higher in the rotation units in September (3,600 versus 3,020 kg/ha, $P < 0.05$). Dead standing crop was also higher in the rotation units in September (1,950 versus 1,570 kg/ha, $P < 0.05$). Evidence suggests the difference in standing crop between systems is due, in part, to reduced forage intake by the livestock. Grazing system did not interact with either stocking rate or year. Stocking rate had significant effects on total, live and

dead standing crops at both sample dates. The slope of the total standing crop-stocking rate relationship varied over years and ranged from -12 to -36 kg/ha per kg live-weight/ha in July and from -12 to -27 kg/ha per kg live-weight/ha in September. Higher standing crop at the end of the grazing season in the rotation units would mean greater soil protection and higher fuel loading for prescribed burning, and would suggest a lower impact on plant vigor. However, if the higher standing crop is a result of lower forage intake, we would expect livestock weight gains to decline.

This citation is from AGRICOLA.

913. Effects of grazing management on streambanks.

Bohn, C. C. and Buckhouse, J. C.

Transactions of the North American Wildlife and Natural Resources Conference 51: 265-271. (1986)

NAL Call #: 412.9 N814; ISSN: 0078-1355

Descriptors: Cervus/ livestock/ Odocoileus hemionus/ runoff/ stocking rate/ streams/ wildlife management/ Oregon

This citation is from AGRICOLA.

914. Effects of grazing on restoration of southern mixed prairie soils.

Fuhlendorf, Samuel D.; Zhang, Hailin; Tunnell, Tim R.;

Engle, David M.; and Cross, Anne Fernald

Restoration Ecology 10(2): 401-407. (2002)

NAL Call #: QH541.15.R45R515; ISSN: 1061-2971

Descriptors: carbon sequestration/ southern mixed prairie soil restoration: grazing effect

Abstract: A comparative analysis of soils and vegetation from cultivated areas reseeded to native grasses and native prairies that have not been cultivated was conducted to evaluate restoration of southern mixed prairie of the Great Plains over the past 30 to 50 years. Restored sites were within large tracts of native prairie and part of long-term grazing intensity treatments (heavy, moderate, and ungrazed), allowing evaluation of the effects of grazing intensity on prairie restoration. Our objective was to evaluate restored and native sites subjected to heavy and moderate grazing regimes to determine if soil nutrients from reseeded cultivated land recovered after 30 years of management similar to the surrounding prairie and to identify the interactive influence of different levels of grazing and history of cultivation on plant functional group composition and soils in mixed prairies. For this mixed prairie, soil nitrogen and soil carbon on previously cultivated sites was 30 to 40% lower than in uncultivated native prairies, indicating that soils from restored sites have not recovered over the past 30 to 50 years. In addition, it appears that grazing alters the extent of recovery of these grassland soils as indicated by the significant interaction between grazing intensity and cultivation history for soil nitrogen and soil carbon. Management of livestock grazing is likely a critical factor in determining the potential restoration of mixed prairies. Heavy grazing on restored prairies reduces the rate of soil nutrient and organic matter accumulation. These effects are largely due to changes in composition (reduced tallgrasses), reduced litter accumulation, and high cover of bare ground in heavily grazed restored prairies. However, it is evident from this study that regardless of grazing intensity, restoration of

native prairie soils requires many decades and possibly external inputs to adequately restore organic matter, soil carbon, and soil nitrogen.

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915. Effects of grazing on the vegetation of the blackbrush association.

Jeffries, D. L. and Klopatek, J. M.

Journal of Range Management 40(5): 390-392. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/405/2jeff.pdf>

Descriptors: Coleogyne ramosissima/ plant communities/ livestock/ vegetation types/ grazing/ Utah/ Arizona

This citation is from AGRICOLA.

916. Effects of grazing on western snowberry communities in North Dakota.

Kirby, D. R.; Sturn, G. M.; and Ransom Nelson, T. A.

Prairie Naturalist 20(3): 161-169. (1988)

NAL Call #: QH540 .P7; ISSN: 0091-0376

Descriptors: Symphoricarpos occidentalis/ Poa pratensis/ cattle/ shrub cover/ herbaceous production/ management strategy

Abstract: Eleven communities dominated by western snowberry (*Symphoricarpos occidentalis*) were compared in 1982 and again in 1986 at the Central Grasslands Research Station in south central North Dakota to examine the impact of cattle grazing under four grazing treatments. Young stems provided 55% of stem compositions in 1982 and 59% in 1986. Shrub cover decreased ($P < 0.05$) season-long, twice-over rotation, and control treatments. Shrubs production averaged across the grazed treatments increased from 142 g/m² in 1982 to 195 g/m² in 1986. Total herbaceous production on treatments averaged 218 g/m² in 1982 and 222 g/m² in 1986. Graminoid species comprised 76% of the herbaceous production; Kentucky bluegrass (*Poa pratensis*) accounted for 68% of the graminoid production. Five years of grazing by cattle under various management strategies, stocking rates, and densities did not consistently alter the structure or composition of western snowberry communities.

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917. The effects of grazing pressure on soil animals and hydraulic properties of two soils in semi-arid tropical Queensland.

Holt, J. A.; Bristow, K. L.; and McIvor, J. G.

Australian Journal of Soil Research 34(1): 69-79. (1996)

NAL Call #: 56.8 Au7; ISSN: 0004-9573

Descriptors: animals and man/ disturbance by man/ commercial activities/ behaviour/ ecology/ community structure/ population dynamics/ habitat/ terrestrial habitat/ land and freshwater zones/ Australasian Region/ Australia/ Acari: farming and agriculture/ population density/ soil fauna/ cattle grazing effects/ soil habitat/ Queensland/ north/ chert towers/ cattle grazing effects on soil fauna/ Acari/ Arachnida/ arachnids/ arthropods/ chelicerates/ insects/ invertebrates

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918. Effects of grazing pressure on weediness in mallee communities studies at Mallee Cliffs National Park and Nanya Station, southwestern New South Wales.

Westbrooke, M. E.

In: The Mallee lands: A conservation perspective. (Held 18 Apr 1989-21 Apr 1989 at Adelaide, South Australia, Australia.) Noble, J. C.; Joss, P. J.; and Jones, G. K. (eds.) East Melbourne, Victoria, Australia: CSIRO Publications; pp. 276-279; 322 p.; 1990.

NAL Call #: QH77.A8N35 1989; ISBN: 0643051058

Descriptors: sheep/ pasture/ conservation/ land use

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919. Effects of herbage removal on productivity of selected high-Sierra meadow community types.

Stohlgren, T. J.; DeBenedetti, S. H.; and Parsons, D. J.

Environmental Management 13(4): 485-491. (1989)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: Carex/ Carex rostrata/ Eleocharis/

Calamagrostis/ Deschampsia cespitosa/ forage/ crop

production/ productivity/ national parks/ grazing intensity/

natural regeneration/ California

This citation is from AGRICOLA.

920. Effects of historic livestock grazing on vegetation at Chaco Culture National Historic Park, New Mexico.

Floyd, M. Lisa; Fleischner, Thomas L.; Hanna, David; and Whitefield, Paul

Conservation Biology 17(6): 1703-1711. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: current grazing/ ecological potential/ edaphic characteristics/ grazing exclosure/ historic livestock grazing/ long term protection/ short term protection/ soil crust/ species richness/ topography

Abstract: Livestock grazing is the most ubiquitous land use in western North America, yet it rarely has been studied in a controlled manner because of the lack of large areas free of grazing. We compared the ecological effects of three grazing treatments-long-term protection, short-term protection, and currently grazed-at Chaco Culture National Historic Park in northern New Mexico. Chaco has a long history of human habitation and is now one of the largest grazing exclosures in the American West. We studied the effects of livestock grazing on the cover of plants, soil crusts, and plant species richness at six sites with different potential natural vegetation. Species richness was higher under long-term protection than under current grazing at all six sites. Trends in shrub and grass response varied significantly across the six sites. Shrub cover increased with long-term protection at four upland sites, and grass cover increased with protection at four sites. The response of Chaco vegetation to release from grazing varied significantly according to each site's ecological potential, determined in part by edaphic and topographic characteristics. These nuances in vegetation response represent natural ecological variation and contrast with the notions of widespread shrub "invasion" often inferred in the past.

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921. Effects of increased precipitation and grazing management on northeastern Montana rangelands.

Branson, F. A. and Miller, R. F.

Journal of Range Management 34(1): 3-10. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/341/1bran.pdf>

Descriptors: ground cover/ forage production/ vegetation changes/ plant communities/ rest rotation

Abstract: To determine possible vegetation changes, 15 plant communities on public lands in the Willow Creek basin near Glasgow, Montana, that were sampled in 1960 were resampled in 1977. Most of the communities showed remarkable improvement in ground cover and forage production. Factors contributing to the changes included higher precipitation during the period between the 1st and 2nd sampling than for the 10-yr period prior to the 1st sampling, and possibly, improved management practices, such as land treatments and application of rest-rotation grazing systems. These results are in conflict with the generally held view that western rangelands have deteriorated.

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922. Effects of late season cattle grazing on riparian plant communities.

Kauffman, J. B.; Krueger, W. C.; and Vavra, M.

Journal of Range Management 36(6): 685-691. (1983)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1983/366/1kauf.pdf>

Descriptors: Salix spp./ Crataegus douglasii/ meadow/ shrub/ forest

Abstract: Livestock impacts on riparian plant community composition, structure, and productivity were evaluated. After 3 yr of comparison between fall grazed and exclosed (nongrazed) areas, 4 plant communities of 10 sampled, displayed some significant species composition and productivity differences. Two meadow types and the Douglas hawthorne (*Crataegus douglasii*) community type had significant differences in standing phytomass. These also were used more heavily than any other communities sampled. Shrub use was generally light except on willow (*Salix* spp.)-dominated gravel bars. On gravel bars, succession appeared to be retarded by livestock grazing. Few differences were recorded in other plant communities sampled, particularly those communities with a forest canopy.

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923. Effects of livestock and prescribed fire on coppice growth after selective cutting of Sudanian savannah in Burkina Faso.

Sawadogo, Louis; Nygard, Robert; and Pallo, Francois

Annals of Forest Science 59(2): 185-195. (2002)

NAL Call #: SD1.A56; ISSN: 1286-4560

Descriptors: fire regimes/ selective cutting: harvesting method/ Sudanian savannah silviculture/ annual early fire/ coppice growth/ livestock grazing/ reduced sprout/ grass competition/ split plot design

Abstract: Can livestock grazing and/or fire regimes be used to promote coppice growth in Sudanian savannah silviculture? Effects of livestock and prescribed fire regimes on stool sprouting after selective cutting were followed during 6 years. Half the initial basal area (at stump height) of 10.8 m² ha⁻¹ (500 stems ha⁻¹) was cut on 48 plots of 0.25 ha each. In a split-plot design with and without

livestock, the effects of annual "early fire" (as soon as possible after end of the rainy season), no fire and 2 years without fire were tested. With moderate (50% of the potential) grazing of 0.7 TLU ha⁻¹ stump mortality decreased and basal area per stool (stems > 10 cm GBH) increased, which we assume was due to reduced sprout/grass competition. Fire regimes had no major impact and no significant interaction was found. Six years after cutting, coppice basal area was 1.1 m² ha⁻¹, corresponding to a recovery of 20% of the initially removed area.
© The Thomson Corporation

924. Effects of livestock grazing on the species diversity and biomass production in the alpine meadows of Garhwal Himalaya, India.

Kala, C. P. and Rawat, G. S.
Tropical Ecology 40(1): 69-74. (1999)
NAL Call #: 451 IN85; ISSN: 0564-3295
Descriptors: biomass/ biomass production/ grazing/ meadows/ species diversity/ biodiversity/ trampling/ alpine grasslands/ grasslands
Abstract: The effects of livestock grazing on the alpine (>3500 m AMSL) vegetation in Khiron Valley, Garhwal Himalaya was studied. The study area was stratified into three landscape units viz., undulating land masses (ULM), camping sites (CS) and steep slopes (SS). Within each stratum two barbed wire enclosures of 10x10x3 m (total six) were erected to exclude livestock grazing. Seasonal aboveground biomass production, both within and outside the enclosures, was estimated by harvest method at 30 days interval. Plant species diversity was calculated for all the sites using Shannon-Wiener diversity index and compared with similar landscape units of ungrazed sites in adjacent valleys. Aboveground biomass values within enclosures were 458±or-27 g m⁻², 419±or-17 g m⁻², and 412±or-18 g m⁻² on the CS, ULM and SS respectively. For grazed areas these values were 352±or-28 g m⁻², 308±or-5 g m⁻² and 318±or-7 g m⁻², respectively. The loss of biomass due to grazing and trampling by livestock was 23%, 26%, and 22% on CS, ULM, and SS respectively. *Danthonia cachemyriana* contributed the most (86.41%) total biomass on SS, whereas *Geranium wallichianum* contributed the most (55.37%) on ULM within the enclosures. Species diversity was highest (H'=2.48) in ULM followed by CS (H'=2.32) and SS (H'=2.00). The differences in species diversity due to grazing in one season were not clear but data from adjacent ungrazed valleys showed that heavy grazing reduces the species diversity, and promotes ruderal and weedy species. The results are discussed in the light of biodiversity conservation.
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925. Effects of livestock management on southwestern riparian ecosystems.

Krueper, D. J.
In: Desired future conditions for Southwestern riparian ecosystems: Bringing interests and concerns together. (Held 18 Sep 1994-22 Sep 1994 at Albuquerque, N. Mex.) Shaw, Douglas W. and Finch, Deborah M. (eds.) Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, U.S. Dept. of Agriculture; pp. 281-301; 1996.
NAL Call #: aSD11.A42 no.272

Descriptors: ecosystems/ livestock/ grazing/ environmental degradation/ habitat destruction/ wildlife/ riparian buffers/ Southwestern United States
This citation is from AGRICOLA.

926. Effects of livestock on riparian zone vegetation in an Australian dryland river.

Robertson, A. I. and Rowling, R. W.
Regulated Rivers Research and Management 16(5): 527-541. (2000)
NAL Call #: TC530.R43; ISSN: 0886-9375
Descriptors: dryland river/ bare soil/ canopy tree density/ coarse particulate organic matter/ livestock grazing/ riparian zone vegetation/ river ecosystem management/ species richness/ terrestrial fine woody debris/ vegetation composition/ vegetation structure
Abstract: Vegetation structure and composition and the mass of components of organic detritus were assessed in paired areas, with and without stock access, at six sites. The study revealed that grazing has altered and continues to alter the structure and function of the riparian landscape in the Murrumbidgee River and its tributaries in southeastern Australia. Seedlings and saplings of the dominant Eucalyptus tree species were up to three orders of magnitude more abundant in areas with no stock access, and the biomass of groundcover plants was an order of magnitude greater in areas with no stock access at all sites. Plant species richness did not differ between areas with and without stock access when the ameliorating effect of canopy tree density was taken into account, but plant community composition differed significantly between areas at all sites. Coarse particulate organic matter and terrestrial fine woody debris were consistently more abundant in areas without stock. In-stream fine and coarse woody debris was more abundant in areas without stock at mainstream sites, but not in tributaries. The percentage of bare soil was greater in areas with stock access at all sites. Differences between areas with and without stock access were generally most pronounced at sites where the riparian zone had been excluded from stock access for more than 50 years. The effects of livestock on vegetation and components of detritus have a significant influence on the function of riparian zones. Efforts to restore river health that focus solely on reducing the impact of regulated flows may be nullified if livestock grazing is not considered as part of river ecosystem management.
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927. Effects of long-term cattle enclosure on vegetation and rodents at a desertified arid grassland site.

Valone, T. J. and Sauter, P.
Journal of Arid Environments 61(1): 161-170. (2005)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
Descriptors: animals and man/ disturbance by man/ commercial activities/ ecology/ population dynamics/ habitat/ terrestrial habitat/ land zones/ Nearctic Region/ USA/ North America/ Rodentia: farming and agriculture/ community structure/ population density/ grassland/ arid grassland/ Arizona/ southeast/ arid grassland faunal response to vegetation changes due to cattle grazing/ Rodentia/ Mammalia/ chordates/ mammals/ rodents/ vertebrates
Abstract: Arid grasslands are often presumed to exist in one of two alternate stable states: grassland or desertified shrubland. While the conversion to shrubland can occur

rather rapidly following intense overgrazing, the recovery of perennial grasses is often presumed to be difficult or impossible even with livestock removal. We examined vegetation and rodent communities at a desertified shrubland site from which livestock had been removed for more than four decades. Total shrub cover was similar but differed in composition across the grazing fence. *Larrea tridentata* had significantly higher cover Outside while *Parthenium incanum* had significantly higher cover inside the fence. Basal perennial grass cover was significantly higher inside the fence. Rodent diversity was significantly higher inside the fence due to higher abundance and diversity of pocket mice. These data suggest that recovery of perennial grasses at severely desertified sites is possible but may require several decades and that rodent diversity responds positively to such recovery. [copyright] 2004 Elsevier Ltd. All rights reserved.

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928. Effects of long-term grazing by big game and livestock in the Blue Mountains forest ecosystems.

Irwin, L. L. and Cook, J. G.

Portland, Ore.: U.S. Department of Agriculture, Pacific Northwest Research Station; PNW-GTR-325, 1994. 49 p.

NAL Call #: aSD11 .A46 no. 325

<http://www.fs.fed.us/pnw/pubs/pnw%5Fgtr325.pdf>

Descriptors: Ungulata/ *Bos taurus*/ *Equus caballus*/ *Ovis aries*/ ungulates/ cattle/ horse/ domestic sheep/ vegetation/ food/ agriculture/ forest grazing land/ damage [forest]/ silviculture/ regeneration/ change in vegetation/ fertility/ recruitment/ population dynamics

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929. Effects of management on soil decomposers and decomposition processes in grassland.

Curry, J. P.

In: Microfloral and faunal interactions in natural and agro-ecosystems/ Mitchell, Myron J. and Nakas, James P.; Vol. 3; Series: Developments in Biogeochemistry 3.

Dordrecht: M. Nijhoff/Dr. W. Junk, 1986; pp. 349-398

NAL Call #: QH344.D4 v.3

Descriptors: grasslands/ grassland soils/ degradation/ *Oligochaeta*/ grazing/ soil biology/ soil management

This citation is from AGRICOLA.

930. Effects of protection from grazing on morphological and chemical characteristics of Indian ricegrass *Oryzopsis hymenoides*.

Trlica, M. J. and Orodho, A. B.

Oikos 56(3): 299-308. (1989)

NAL Call #: 410 OI4; ISSN: 0030-1299

Descriptors: vegetative tiller/ plant height/ leaf growth/ aboveground biomass/ adaptive plasticity

Abstract: Protection from previous heavy grazing for 50 yr in a national park in southwestern United States has not resulted in any significant increase in height of Indian ricegrass (*Oryzopsis hymenoides* [Roem. and Schult.] Ricker) compared with in situ plants that were previously heavily grazed, and no difference in height or aboveground biomass was detected among grazed and ungrazed populations when grown in a uniform garden. Tussocks heavily utilized in the past produced greater numbers of vegetative tillers than did plants that were protected within the park. However, these differences were not evident when grazed and ungrazed populations were grown in a

uniform garden. Protection from heavy grazing had no significant effect on fiber, cellulose, or lignin in either leaves or stems. Small differences in morphological and chemical characteristics between heavily-grazed and protected populations of Indian ricegrass could be attributed to plastic adaptations with no underlying genetic selection for defense mechanisms to reduce herbivory. Rapid leaf growth after defoliation appears to be the mechanism employed by this tussock grass to withstand heavy grazing use.

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931. Effects of rainfall and grazing on vegetation yield and cover of two arid rangelands in Kuwait.

Zaman, Sameeha

Environmental Conservation 24(4): 344-350. (1997)

NAL Call #: QH540.E55; ISSN: 0376-8929

Descriptors: arid rangelands/ desertification/ grazing impact/ human impact/ phytomass/ rainfall/ seasonal variation/ steppe/ vegetation yield

Abstract: Increasing human pressure has presumably led to a decrease in the cover and herbage yield of Kuwaiti desert vegetation, but, to date, there has been little detailed study on such human impacts. A study of *Rhanterium epapposum* (local name arfaj) and *Haloxylon salicornicum* (local name remeth) steppe was therefore effected to determine the seasonal variation in above-ground phytomass and percentage cover, and to investigate differences between protected and adjacent grazed areas. An average seasonal precipitation of 90 mm supported a mean of 223 kg ha⁻¹ in arfaj steppe in 1979-1989, whereas an average mean seasonal precipitation of 73 mm during 1983-1989 maintained a mean phytomass of 102 kg ha⁻¹ in the remeth steppe. Annual forbs and perennial shrubs were the greatest producers of dry matter per kg of phytomass in the arfaj and remeth steppes, respectively. The seasonal production of dry matter was related directly to the seasonal precipitation in the arfaj steppe, whereas the remeth steppe did not show an obvious relationship to the precipitation. The plant cover was 83% and 70% less, and herbage production was 76% and 91% less in grazed areas than in protected areas in the arfaj and remeth steppes, respectively.

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932. Effects of reducing sheep grazing in the Scottish Highlands.

Hope, D.; Picozzi, N.; Catt, D. C.; and Moss, R.

Journal of Range Management 49(4): 301-310. (1996)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1996/494/301-310_hope.pdf

Descriptors: sheep/ grazing/ stocking rate/ botanical composition/ *Cervus elaphus*/ sward/ canopy/ plant communities/ ecological succession/ voles/ rangelands/ prescribed burning/ Scotland

Abstract: The effects of reducing sheep grazing on upland vegetation and wild herbivores was studied at 11 sites in the Scottish Highlands. Areas where sheep had been removed for periods of up to 25 years were compared with areas where stocking rates had remained unchanged. At 5 sites, removal of sheep was associated with taller vegetation and more signs of vole activity. While the removal of sheep appeared to have resulted in relatively few changes in floristic composition at these sites, patches

of dwarf shrub-dominated vegetation tended to be larger and patches of grassland to be smaller where sheep had been removed. One previously open site was being invaded by birch woodland after sheep removal. At the remaining 6 sites removal of sheep appeared to have had little or no effect on vegetation or on wild herbivore activity. This was probably due to an increase in grazing by red deer, along with continued heather burning, at these sites. It is concluded that sheep removal is only likely to cause significant changes in vegetation composition and structure in the Scottish Highlands where red deer numbers are low and heather burning infrequent. When this occurs, vole numbers are likely to increase. This citation is from AGRICOLA.

933. Effects of seasonal flooding and grazing on the vegetation of former ricefields in the Rhone delta (southern France).

Mesleard, F.; Lepart, J.; Grillas, P.; and Mauchamp, A. *Plant Ecology* 145(1): 101-114. (1999)
 NAL Call #: QK900.P63; ISSN: 1385-0237
 Descriptors: abandoned land/ *Oryza sativa*/ wetlands/ seasonal variation/ grazing/ vegetation/ water management/ ecological succession/ salinity/ rain/ cattle/ land management/ horses/ plant communities/ irrigation/ botanical composition/ France
 Abstract: Six management regimes were tested during 5 years in 18 abandoned ricefields in the Rhone delta, France: two artificial floodings for 6 months (winter and summer flooding, 10 cm deep) and a control only flooded by rain, each flooding treatment either with or without grazing by cattle and horses. In the absence of artificial flooding and in presence of grazing by domestic herbivores (i.e., maintaining the initial management since the abandonment) no significant change in plant communities was recorded after 5 years. The vegetation was mainly composed of halophytes (*Salicornia fruticosa* and *Inula crithmoides*). The removal of grazing led to the dominance of a salt tolerant grass: *Aeluropus litoralis*. Flooding favoured the dominance of clonal plants and led to a decrease in the number of species. In the ungrazed fields, changes in plant communities were related to the height of species with *Bolboschoenus maritimus* and *Phragmites australis* becoming dominant. When grazing was combined with summer flooding, *B. Maritimus* dominated the first two years of the experiment, but with a low cover, and was replaced in the 3rd year by *Typha angustifolia*. When grazing was combined with winter and early spring flooding the competitive exclusion of *B. maritimus* by *Juncus gerardii* slowed the establishment of the former. The management of former ricefields led to the establishment and dominance of emergent species common to Mediterranean wetlands. Although it is subordinate to the maintenance of artificial flooding, the project may be considered a restoration (or a rehabilitation) of seasonally flooded marshes as original functions existing before the land was put under cultivation are re-established. This citation is from AGRICOLA.

934. Effects of seasonal grazing on plant species diversity and vegetation structure in a semi-arid ecosystem.

Metzger, K. L.; Coughenour, M. B.; Reich, R. M.; and Boone, R. B.
Journal of Arid Environments 61(1): 147-160. (2005)
 NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
 Descriptors: nutrition/ diet/ feeding behaviour/ ecology/ habitat/ terrestrial habitat/ land zones/ Afrotropical Region/ Africa/ *Connochaetes taurinus* (Bovidae): food plants/ foraging/ impact on habitat/ grassland/ Tanzania/ Serengeti National Park/ seasonal grazing impact on plant species diversity and vegetation structure/ semi arid ecosystem/ Bovidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ ungulates/ vertebrates
 Abstract: In evolutionary time frames, grazing by domesticated livestock on the short grass plains of East Africa is a new occurrence resulting in increased animal densities year around and modification to annual timing of grazing. We addressed the following questions: (1) do plant species diversity and vegetation structural differences exist between an area that is grazed only during the wet season and an adjacent area that is grazed year around; and, (2) does plant species diversity and structure correlate temporally with density of grazers? A spatially explicit ecosystem model was used to determine grazer densities. The two areas were similar with respect to grazer density during the wet season but not in the dry season. Dry season grazer densities were solely due to the presence of domesticated livestock. No significant differences in plant species diversity (H'), evenness, or richness were found between the two areas. However, the relative abundance of forbs, shrubs, percent cover of shrubs and bare ground was positively correlated with grazer densities during the dry season. [copyright] 2004 Elsevier Ltd. All rights reserved. © The Thomson Corporation

935. Effects of sheep exclusion on the soil seed bank and annual vegetation in chenopod shrublands of south Australia.

Meissner, Rachel A. and Facelli, Jose M.
Journal of Arid Environments 42(2): 117-128. (1999)
 NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
 Descriptors: annual vegetation/ chenopod shrublands/ grazing exclusion: plant community structure/ soil seed bank
 Abstract: This study investigated the composition of the soil seed bank and growing annual plant community in sheep-grazing exclosures. The effects of stock exclusion on annual plant community structure was slight, and was different in the seed bank and in the growing community because of little correspondence between the two. Stock exclusion favoured a few species, but never decreased the abundance of invasive species. It had little or no effect on species diversity. We conclude that grazing exclusion of the order of a decade is not enough to reverse changes produced by long-term grazing. © The Thomson Corporation

936. Effects of sheep grazing on a riparian-stream environment.

Platts, W. S. Intermountain Forest and Range Experiment Station, U.S. Department of Agriculture, 1981. 6 p. Research Note.

NAL Call #: A99.9 F764Un

Descriptors: grazing/ habitat alterations/ management/ research--rivers and streams/ riparian habitat
© NISC

937. Effects of sheep grazing on a spotted knapweed-infested Idaho fescue community.

Olson, B. E.; Wallander, R. T.; and Lacey, J. R. *Journal of Range Management* 50(4): 386-390. (1997)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1997/504/386-390_olson.pdf

Descriptors: sheep/ grazing/ seedlings/ plant density/ *Festuca idahoensis*/ plant communities/ range management/ weed control/ Idaho

Abstract: Spotted knapweed (*Centaurea Maculosa* Lam.), a Eurasian perennial forb, is replacing many native perennial grasses, such as Idaho fescue (*Festuca idahoensis* Elmer.), in foothills of the Northern Rocky Mountain region. Our objective was to determine if 3 summers of repeated sheep grazing would reduce spotted knapweed without impacting the dominant, associated native perennial grass. Each summer, small pastures were grazed for 1-7 days in mid-June, mid-July, and early September. Areas repeatedly grazed by sheep had lower densities of seedlings, rosettes, and mature spotted knapweed plants than ungrazed areas. In addition, the proportion of young plants in the population was less in grazed than ungrazed areas. Basal areas of spotted knapweed plants were greater in grazed (8.2 cm²) than ungrazed areas (4.0 cm²). There were fewer spotted knapweed seeds in soil samples from grazed areas (12 seeds m⁻²) than from ungrazed (49 seeds m⁻²). Idaho fescue plant density increased 40% in grazed areas from 1991 to 1994, but leaves and flower stems on these plants were 38% and 17% shorter, respectively, than in ungrazed areas. By 1994, frequency of Kentucky bluegrass (*Poa pratensis* L.) was 35% greater in grazed than ungrazed areas. Grazing did not alter the amount of litter; however the amount of bare soil increased from 2.2 to 5.6% in grazed areas, while it decreased from 4 to 1% in ungrazed areas. Three summers of repeated sheep grazing negatively impacted spotted knapweed, but minimally affected the native grass community. A long term commitment to repeated sheep grazing may slow the rate of increase of spotted knapweed in native plant communities.

This citation is from AGRICOLA.

938. The effects of sheep-grazing on the subterranean termite fauna (Isoptera) of the western Australian wheatbelt.

Abensperg Traun, M.

Australian Journal of Ecology 17(4): 425-432. (1992)

NAL Call #: QH540.A8; ISSN: 0307-692X

Descriptors: abundance/ frequency/ soil/ species diversity/ trampling/ wandoo woodland

Abstract: The majority of existing remnants of wandoo *Eucalyptus capillosa* woodland in the Western Australian wheatbelt have been grazed by sheep for several decades

and are often visibly degraded. A pilot survey was conducted into the effects of sheep on vegetation and soil variables, and the abundance, diversity and species frequency of occurrence of subterranean termite communities. Ten 1/4 ha study plots were used for paired grazed/ungrazed comparisons. Ungrazed plots had more litter mass (dry weight), leaf and woody litter, canopy cover (%) and soil moisture (moisture content 1.2% across study plots); grazed plots had a higher percentage of bare ground. Termites were as abundant, and as diverse, in grazed as in ungrazed plots, and were equally often sampled in the soil and surface wood. Termite species eating sound wood, decayed wood/debris and grass were sampled equally often, and were of equal diversity in sheep-grazed as in ungrazed plots. The mounds of *Drepanotermes tamminensis* were more abundant in grazed plots. These findings indicate that prolonged sheep grazing in remnants of wandoo woodland of the Western Australian wheatbelt has had no detrimental or beneficial effect on its subterranean termites.

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939. Effects of short duration and high-intensity, low-frequency grazing systems on forage production and composition.

Taylor, C. A.; Brooks, T. D.; and Garza, N. E. *Journal of Range Management* 46(2): 118-121. (1993)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/462/6tayl.pdf>

Descriptors: ewes/ heifers/ grazing/ pastures/ stocking rate/ grazing intensity/ forage/ dry matter accumulation/ botanical composition/ ecological succession/ Texas

Abstract: Research was conducted at the Sonora Research Station during a 4-year period (1984 to 1988) to measure differences in herbaceous vegetation response between two 7-pasture 1-herd grazing systems. Grazing tactics were short duration (SDG-7 days graze, 42 days rest) and high intensity, low frequency (HILF-14 days graze, 84 days rest). Stocking rate for the 2 treatments was 10.4 ha/auy. Total aboveground net primary production (ANPP) varied significantly among years but not between grazing treatments. Significant, divergent shifts in composition did occur over the 4 years as a function of grazing treatment. Shortgrass production in the SDG pastures increased from 45% of the total ANPP for year 1 to 74% for year 4. Shortgrass ANPP in the HILF pastures comprised 44% of the total herbaceous production for year 1 and 51% for year 4. Midgrass ANPP in SDG pastures comprised 3.8% of the herbaceous production for year 1 and 13.6% for year 4. Midgrass production in the HILF pastures represented 4.7% for year 1 and 33.9% for year 4. Our data indicate the SDG system did not promote secondary succession from shortgrasses to midgrasses as effectively as did the HILF system.

This citation is from AGRICOLA.

940. Effects of short-duration on winter annuals in the Texas Rolling Plains.

Weigel, J. R.; McPherson, G. R.; and Britton, C. M. *Journal of Range Management* 42(5): 372-375. (1989)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1989/425/5weig.pdf>

Descriptors: annuals/ rotational grazing/ grazing intensity/ botanical composition/ Texas

Abstract: A study was conducted in the Texas Rolling Plains to test the hypotheses that short-duration grazing increases plant density and diversity in grasslands. Densities of 9 species of winter annual forbs and 2 species of annual grass were compared in short-duration grazed and ungrazed areas for 2 years. Livestock grazing in spring and early summer affected density of 8 winter annuals the following winter. Densities of 2 grasses [little barley (*Hordeum pusillum* Nutt.) and six-weeks fescue (*Vulpia octoflora* [Walt.] Rydb.)] and 3 forbs [common broomweed (*Xanthocephalum dracunculoides* [DC.]), Gordon's bladderpod (*Lesquerella Gordonii* [Gray] Wats.), and Texas filaree (*Erodium texanum* Gray.)] were higher in grazed areas; 3 forbs [bitterweed (*Hymenoxys odorata* DC.), spurge (*Euphorbia* sp.), and woolly pliantain (*Plantago patagonica* Jacq.)] were more abundant in enclosures. Richness and diversity of winter annuals generally were not affected by grazing. Increased precipitation during germination and establishment greatly increased the density of winter annuals.
This citation is from AGRICOLA.

941. Effects of soil water regime and grazing on vegetation diversity and production in a hyperseasonal savanna in the Apure Llanos, Venezuela.

Sarmiento, G.; Pinillos, M.; Da Silva, M. P.; and Acevedo, D.
Journal of Tropical Ecology 20(2): 209-220. (2004)
NAL Call #: QH541.5.T7J68; ISSN: 0266-4674
Descriptors: savannahs/ grazing/ soil moisture/ biomass/ water content/ droughts/ species richness/ primary production/ *Leersia hexandra*/ *Axonopus purpusii*/ *Panicum laxum*/ *Paspalum chaffanjonii*/ Venezuela
Abstract: Soil water content and above-ground biomass accumulation, above 10 cm high, were measured monthly in a flooded savanna ecosystem under grazing pressure and under cattle exclusion, during two growth cycles. Near-to-the-ground and below-ground biomass were measured three times during this period. Besides, composition, species richness and diversity were obtained through a floristic inventory. Despite a relatively high floristic richness and diversity, *Panicum laxum* is the dominant species throughout the study area, while three other perennial grasses, *Paspalum chaffanjonii*, *Leersia hexandra* and *Axonopus purpusii*, also reach high values of cover and biomass. Each of them reacts specifically to flooding, drought and grazing conditions. This ecosystem shows a strongly seasonal behaviour, with primary production, mortality and decomposition sharply timed by soil relative water content. Both drought and water excess seem to limit plant production, even more during wet years when the savanna might remain flooded for up to 4 mo. Some structural and functional differences between the grazed and the protected systems are demonstrated, but under the actual, relatively low stocking rate, the grazed savanna produces as much forage as the ungrazed one.
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942. Effects of sowing and management on vegetation succession during grassland habitat restoration.

Warren, John; Christal, Anna; and Wilson, Fred
Agriculture, Ecosystems & Environment 93(1-3): 393-402. (2002)
NAL Call #: S601 .A34; ISSN: 0167-8809
Descriptors: cutting treatment: applied and field techniques/ grazing treatment: applied and field techniques/ habitat restoration: applied and field techniques/ sowing: applied and field techniques/ Sorenson's qualitative similarity index/ Sorenson's quantitative similarity measure/ community change/ former agricultural land/ grassland habitat restoration/ semi natural community/ summer grazing/ vegetation succession: management effects, sowing effects
Abstract: The impact of sowing a seed mixture to recreate a semi-natural community in combination with six cutting and/or grazing treatments on the vegetation that developed on former agricultural land was examined over 6 years. Introducing seeds significantly increased the number and cover of sown species persisting. Summer grazing by cattle maintained the number, but not cover, of sown species. Few sown species persisted when grazed by sheep, although those that did maintained high cover. Sorenson's qualitative similarity index (based solely on species presence or absence data) revealed that pairs of sown and non-sown plots within a management treatment did not appear to converge during succession. However, using Sorenson's quantitative similarity measure (based on both species occurrence and abundance) pairs of plots became increasingly similar after the first year. The sown plots became less similar to each other using the qualitative similarity measure, but this was less marked using the quantitative measure. In contrast, the non-sown plots became less similar to each other with the quantitative measure, but no changes were observed with the qualitative measure. The vegetation in the sown plots became more like that in the non-sown plots as sown species failed to persist. In contrast, the non-sown plots became more like the sown plots as the sown grasses *Agrostis capillaris* and *Festuca rubra* increased in abundance. The exception to this was the cattle-grazed sown plots, which retained more sown species, however, succession in this treatment also converged towards the non-sown plots because the non-sown species *Trifolium repens* and *Ranunculus repens* increased in abundance in this treatment. The addition of seeds of a desired grassland community appeared to have less effect in directing the trajectory of succession than did the vegetation management.
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943. Elements of grazing strategies for perennial grass management in rangelands.

Hodgkinson, Ken C.
In: *Desertified grasslands: Their biology and management.* (Held 1 Feb 1927 at London.) Chapman, G. P. (eds.) London: Academic Press; pp. 77-94; 1992.
NAL Call #: QK658.A1L5 no.13; ISBN: 0121685705
Descriptors: grasslands--congresses/ grassland ecology--congresses/ desertification--control--congresses/ grasslands--management--congresses
This citation is from AGRICOLA.

944. Elk and cattle forage use under a specialized grazing system.

Halstead, L. E.; Howery, L. D.; Ruyle, G. B.; Krausman, P. R.; and Steidl, R. J.

Journal of Range Management 55(4): 360-366. (2002)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: beef cattle/ grazing/ *Cervus elaphus canadensis*/ stubble/ rotational grazing/ topography/ wildlife management/ *Pascopyrum smithii*/ canopy/ Arizona

Abstract: The Walker Basin Allotment grazing system in central Arizona is designed to allocate resource use under elk (*Cervus elaphus* L.) and cattle (*Bos taurus* L.) grazing. The grazing system was designed to promote biologically acceptable levels of forage use on the half of the allotment scheduled for cattle grazing and to rest the other half by attracting elk to pastures recently grazed by cattle. The objectives of our 2-year study were to determine whether the grazing system facilitated proper forage use as defined by recent forage use and residual stubble height guidelines (i.e., 30 to 40% use and an 8- to 10-cm stubble height) and whether the system rested one half of the allotment from elk and cattle grazing. Mean (+/- SEM) total elk and cattle forage use for western wheatgrass (*Pascopyrum smithii* Rydb.), the key forage species, was 32 and 61% +/- 7 in 1997 and 1998, respectively; corresponding mean (+/- SEM) stubble heights were 11 and 10 cm +/- 0.6. Mean total cattle and elk forage use in 1998 (61%) exceeded the 30 to 40% use guidelines. However, mean end-of-year stubble height was never below 10 cm. The grazing system did not provide half the allotment with complete rest; elk used all study pastures. Elk use was higher in pastures with heavier tree cover and steeper terrain in both years, regardless of where cattle grazing occurred. Elk grazing patterns were apparently more dependent on tree cover and topography than any changes in forage caused by the grazing system.

This citation is from AGRICOLA.

945. Environmental effects of low intensity systems of animal production in the hills and uplands of the UK.

Milne, J. A.

Animal Science 63(3): 363-371. (1996)

NAL Call #: SF1.A56; ISSN: 0003-3561

Descriptors: animal production/ environmental impact/ grazing systems/ nature conservation/ vegetation/ grasslands/ grazing/ grazing intensity/ upland grasslands

Abstract: The extent to which grazing intensities of animal production systems in the uplands of the United Kingdom cause impacts on vegetation, soils, birds, mammals and invertebrates, and influence landscape value and water quality are reviewed. It is argued that these impacts need to be considered in an integrated manner in relation to their responses at the field and landscape scales. Evidence is presented which suggests that a range of grazing intensities is required to obtain significant benefits to the natural heritage. This suggests that new approaches are required to the mechanisms of delivering environmental benefits from grazing systems.

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946. Equilibrium and non-equilibrium models of livestock population dynamics in pastoral Africa: Their relevance to Arctic grazing systems.

Behnke, R. H.

Rangifer 20(2-3): 141-152. (2000)

NAL Call #: QL737.U55R341; ISSN: 0333-256X

Descriptors: carrying capacity/ conservation biology/ drought/ economic conditions/ equilibrium dynamics/ food availability/ nonequilibrium dynamics/ overgrazing/ population dynamics/ production strategies/ rainfall/ semi arid rangelands: habitat/ snow cover/ social conditions/ stock density/ temperature

Abstract: Equilibrium grazing systems are characterised by climatic stability that results in predictable primary production. Non-equilibrium grazing systems receive low and erratic rainfall that produces unpredictable fluctuations in forage supplies. In semi-arid Africa, these two types of environment present livestock owners with very different management problems. Identifying and maintaining optimal stocking rates is useful in equilibrium systems because livestock reproduce and produce at a rate determined by the availability of feed, which is an inverse function of stock density. The only problem is to determine what stocking rate is optimal. The correct stocking rate for a grazing system will vary depending on the production strategy and the social and economic circumstances of the rangeland user - there is no single, biologically predetermined optimum density. Variable rainfall complicates the picture in non-equilibrium systems. Set stocking rates of any kind have little value if fluctuation in rainfall has a stronger effect than animal numbers on the abundance of forage. More useful in such an environment is the ability to adjust stocking rates rapidly to track sudden changes in feed availability. In semi-arid Africa, the distinction between equilibrium and non-equilibrium systems hinges on the reliability of rainfall. In northern latitudes, at least three primary variables important for plant growth and the survival of herbivores must be considered: rainfall, snow cover and temperature. It is probably not useful to consider arctic grazing systems as equilibrium systems; on the other hand, the non-equilibrium models developed in hot semi-arid environments do not capture the range of complexity which may be an inherent feature of plant-herbivore dynamics on the mountain and tundra pastures where reindeer are herded or hunted.

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947. An evaluation of grazing intensity influences on California annual range.

Rosiere, R. E.

Journal of Range Management 40(2): 160-165. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/402/17rosi.pdf>

Descriptors: *Trifolium subterraneum*/ *Bromus mollis*/ *Bromus rigidus*/ *Avena barbata*/ *Avena fatua*/ *Hordeum leporinum*/ *Hordeum hystris*/ *Festuca dertonensis*/ *Festuca megalura*/ *Erodium cicutarium*/ *Erodium botrys*/ growth/ environmental conditions

Abstract: Influences of grazing intensity on species composition and herbage production of grass-woodland and improved grassland subtypes of annual range were evaluated over a 5-year period in coastal northern California using 3 grazing treatments (100, 150, and 200% of moderate stocking). Herbage utilization did not differ significantly between the 2 subtypes but averaged 42, 52,

and 69% for the respective treatments. Plants species and production responses differed significantly between woodland and grassland subtypes. On woodland, rigput brome (*Bromus rigidus* Roth.) and wild oats (*Avena barbata* Brot. and *A. fatua* L.) were most sensitive to grazing intensity while wild barley (*Hordeum leporinum* Link. and *H. hystrix* Roth.) and annual fescue (*Festuca dertonensis* (all.) Asch. and Graebn. and *F. megalura* Nutt.) were least sensitive. On improved grassland, subterranean clover (*Trifolium subterraneum* L.) increased and soft chess (*Bromus mollis* L.) decreased with increasing grazing intensity. Soft chess remained most plentiful on woodland range under heaviest grazing and it continued to be a major species under heavy grazing of grassland, demonstrating tolerance to grazing intensity. Filaree (*Erodium cicutarium* (L.) L'Her. and *E. botrys* (Cav.) Bertol.) declined on woodland but increase on grassland as grazing intensified. Peak standing crop was not significantly affected by grazing intensity on woodland range but was greatest at 150% of moderate stocking and lowest at 200% of moderate stocking on grassland range. Decline in grassland herbage yield under heaviest grazing was due to reduction of soft chess which was displaced by subterranean clover. Effects of grazing intensity on range composition and productivity were confounded by innate differences in ranges and yearly weather patterns. Herbage production was impacted more by annual growing conditions than by grazing regimens, but there was no correlation between total annual precipitation and peak standing crop.

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948. Evaluation of rest-rotation grazing in the Missouri River Breaks on the Charles M. Russell National Wildlife Refuge, Montana.

Oldemeyer, J. L.; Reid, V. H.; Nickey, D. A.; and Hedrick, M.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 32-46; 1982.
NAL Call #: SF84.84.W5 1981

949. An evaluation of the empirical basis for grazing management recommendations for rangeland in southern Africa.

O'Reagain, P. J. and Turner, J. R.

Journal of the Grassland Society of Southern Africa 9(1): 38-49. (1992)
NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: sheep/ cattle/ goats/ continuous grazing/ rotational grazing/ stocking rate/ range degradation potential/ veld type/ South Africa

Abstract: Analysis of over 50 grazing experiments conducted in southern Africa does not support certain management recommendations. Furthermore, the conclusions of some experiments are questionable owing to poor experimental design or confirmation bias. Based on available evidence, it was concluded that (i) stocking rate has a major impact on range condition and animal production, (ii) continuous and rotational grazing or pauci- and multi-camp systems differ little in terms of their effects upon range condition or animal production, (iii) sheep have a greater potential for range degradation than either cattle or goats, but this effect may be ameliorated and sheep

production increased by stocking sheep with cattle at narrow ratios, (iv) separation of veld types appears important, and (v) regular seeding or vigour rests, or rests to accumulate fodder, appear essential. Simple grazing systems using adaptive and opportunistic management are recommended.

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950. Factors influencing eastern redcedar seedling survival on rangeland.

Schmidt, T. L. and Stubbendieck, J.

Journal of Range Management 46(5): 448-451. (1993)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/465/13schm.pdf>

Descriptors: Juniperus virginiana/ plant competition/ grazing/ Nebraska

Abstract: Eastern redcedar (*Juniperus virginiana* L.) is the most rapidly expanding woody species on rangeland in the Great Plains. Reasons for the expansion and management solutions have not been determined. The objective of this study was to determine the effect of year of establishment, grazing impacts, and aspect on the survival of eastern redcedar seedlings. Subplots of 10 transplanted eastern redcedar seedlings were replicated at 2 sites in west-central Nebraska. Plots were established in 1987 and 1988 under 3 different grazing levels: actively grazed, actively grazed until 1987 and then fenced from grazing, and not grazed for greater than or equal to 50 years. Split-plots within the 3 grazing levels were established on 3 different aspects: north-facing, south-facing, and flat. Seedling survival was evaluated 6, 18, and 30 months after establishment period. The year that the seedling was established influenced seedling survival after 18 months. Grazing effects and aspect were significant factors in the survival of eastern redcedar seedlings for all 3 evaluation periods. Highest survival for grazing effects occurred where eastern redcedar seedlings were transplanted into plots that were grazed until 1987 and then fenced (57% +/- 1.5%). Lowest survival rates concerning grazing were for areas that were not grazed for greater than or equal to 50 years (40% +/- 3.0%). North-facing slopes had the highest survival after 30 months (65% +/- 2.4%). South facing slopes had the lowest survival after 30 months (34% +/- 2.9%). Land managers may be able to reduce eastern redcedar seedling establishment on grazed range lands through different grazing practices.

This citation is from AGRICOLA.

951. A fence-line contrast reveals effects of heavy grazing on plant diversity and community composition in Namaqualand, South Africa.

Todd, S. W. and Hoffman, M. T.

Plant Ecology 142(1/2): 169-178. (1999)
NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: plant communities/ species diversity/ grazing/ plants/ overgrazing/ grazing intensity/ rangelands/ botanical composition/ palatability/ shrubs/ annuals/ plant morphology/ volume/ seedlings/ population dynamics/ land use/ community ecology/ South Africa

Abstract: Changes in plant species richness and community composition were investigated across a fence separating heavily grazed communal and lightly grazed commercial farming systems in Namaqualand, South Africa. No significant differences in plant species richness between communal and commercial farming systems were

detected either locally within individual plots or overall across all plots. Within-plot, richness of species tolerant of grazing, such as annuals and geophytes, has increased, while the richness of large palatable shrub species has decreased on the communal rangeland. In terms of plant cover, species' responses to grazing were strongly associated with growth form. Annuals and geophytes formed the majority of grazing increasers, while large, presumably palatable, shrubs and leaf succulents were characteristic grazing decreaseers. An investigation into population processes of five shrub species revealed that heavy grazing on the communal rangeland has resulted in: reduced size of palatable shrub species; reduced flower production and seedling recruitment of palatable species; increased density and recruitment of the unpalatable shrub, *Galenia africana*. Reductions in shrub volume, reproductive output and seedling recruitment were most marked in the palatable shrub *Osteospermum sinuatum* and were in the order of 90%. The results are further discussed in terms of their relevance to rangeland dynamics and the current land use practices of the region.

This citation is from AGRICOLA.

952. Forage height and mass in relation to grazing management.

Wright, I. A.

In: Emerging technology and management for ruminants: 1985 Livestock Seminars, International Stockmen's School/ Baker, Frank H. and Miller, Mason E.

Morillon, Ark.: Winrock International, 1985; pp. 341-348
NAL Call #: SF191.2.168

Descriptors: beef cattle/ grazing/ stocking rate/ range management/ forage crops/ height/ mass

This citation is from AGRICOLA.

953. Frequent mowing is better than grazing for the conservation value of lowland tussock grassland at Pontville, Tasmania.

Verrier, Frances J. and Kirkpatrick, J. B.

Austral Ecology 30(1): 74-78. (2005)

NAL Call #: QH540 .A8; ISSN: 1442-9985

Descriptors: mowing: applied and field techniques/ biomass reduction/ conservation value/ lowland tussock grassland/ moderate grazing/ rare species

Abstract: The effects of an unusual high frequency mowing regime, which involved the removal of slash, were compared to moderate grazing through the method of paired quadrats across a fenceline, which was orthogonal to a weak environmental gradient. The mown plots proved superior in their conservation characteristics to the moderately grazed plots. The mowing regime produced greater cover of rare or threatened species, greater native cover and lesser exotic grass cover. It thus presents an opportunity for maintaining or improving the condition of previously grazed remnants in reserves without resorting to the use of stock or fire for biomass reduction.

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954. Grass composition and rangeland condition of the major grazing areas in the Mid Rift Valley, Ethiopia.

Sisay, Amsalu and Baars, R. M. T.

African Journal of Range and Forage Science 19(3): 161-166. (2002)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: altitude zones/ grass composition/ grazing pressure/ rangeland condition/ soil erosion

Abstract: A range inventory and condition study was conducted in three altitude zones: lowland (1 500-1 700m), medium altitude (1 700-2 000m), and highland (2 000-2 500m). Each altitude zone was stratified into four or five important grazing areas. One area represented lightly grazed government ranches or parks which were used as benchmarks, another area represented the seasonal grazing areas with an intermediate grazing pressure and the remaining were the heavily grazed roadsides, lakeshores and other communal grazing lands. The range condition assessment was based on the composition of the herbaceous layer, basal cover, litter cover, relative number of seedlings, age distribution of grasses, soil erosion and soil compaction. Dry matter was sampled in the mid-wet season to assess the relationship between available dry matter and range condition. A total of 36 grass species, 3 legume species, 2 sedge species, 15 other herbs and 31 species of trees were identified. The palatable *Cenchrus ciliaris* was dominant in the benchmarks and seasonally grazed areas of the lowland while *Hyparrhenia* spp. dominated in the same areas of the medium altitude.

Cynodon dactylon, and the non-palatable *Eleusine floccifolia* and *Pennisetum schimperi* were dominant on heavily grazed areas of the lowland, medium altitude and highland, respectively. The total score for range condition of the benchmarks (34 out of 50 points), was significantly higher than that of the seasonally grazed areas (26), the heavily grazed communal grazing areas (19), roadsides (16) and lakeshores (17) ($P < 0.05$). The highlands showed a higher score for benchmarks and seasonally grazed areas only. There was a significant linear relationship between available dry matter of grasses and range condition (excluding unpalatable pioneer grasses, $r^2 = 0.56$, $P < 0.01$). Seasonally grazed areas were identified as key sites for pasture improvement since these are privately owned and managed. Pasture improvement will reduce the grazing pressure on the heavily grazed roadsides, lakeshores and other communally grazed areas.

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955. Grassland recovery by protection from grazing in a semi-arid sandy region of northern China.

Zhang, Ji Yi; Wang, Ying; Zhao, Xia; Zhang, Ting; and Xie, Gang

New Zealand Journal of Agricultural Research 48(2): 277-284. (2005)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: desertification/ grazing/ biodiversity loss/ grassland recovery/ semi arid sandy region/ community structure development/ community function restoration

Abstract: Vegetation destruction resulting from overgrazing and conversion of rangelands to agricultural use is one of the biggest causes of land desertification and biodiversity loss. The community cover, biomass, species composition, species richness, and species diversity of each of six sites protected from grazing for times ranging from 3 to 45 years were investigated in a semi-arid sandy region called Horqin Sandy Land, northern China. Community cover was maximal in the site with 45 years protection from grazing, and biomass was maximal in the site with 18 years' protection due to the vigorous growth of *Artemisia halodendron*. Species richness and diversity tended to increase as protected time increased. The results showed

that up to 45 years' protection from grazing produced positive and encouraging changes in the site. As the number of years of protection increased, the development of community structure and restoration of community function increased. The study provided an example of grassland recovery under natural conditions in this semi-arid sandy region, and suggested that protection from grazing may be an effective, financially economical and natural way to restore vegetation. It is suggested that this could be of great significance for land use and management practices.

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956. The grassy vegetation of the Darling Downs south-eastern Queensland, Australia: Floristics and grazing effects.

Fensham, R. J.

Biological Conservation 84(3): 301-310. (1998)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: exotic species spread/ floristics/ grassland: habitat/ grazing/ mechanical disturbance/ species richness/ woodland: habitat

Abstract: An ordination of floristic data from the grassy vegetation of the Darling Downs in southern Queensland describes four broad vegetation types, red gum (*Eucalyptus camaldulensis*/E. *tereticornis*) woodland associated with the flood-plain of the major streams, grassland on alluvial clay, poplar box (*E. populnea*) on clay loam terraces and hill woodland dominated by any of *E. albens*, *E. crebra*, *E. melliodora*, *E. orgadophila*. Ten per cent of species proved sensitive to grazing intensity categories (derived largely from land tenure) in hill woodland compared to 3% of species in grassland or poplar box woodland. There were no clear trends in the relative response of native and exotic species, although overall, species richness was greatest in either the moderate or heavily grazed treatment for all broad vegetation types. It is suggested that the interaction between Themeda dominance and the inter-tussock flora may contribute to the importance of grazing as a determinant of floristic composition in hill woodland broad vegetation type. Mechanical disturbance is implicated as a means of effecting the spread of exotic plants. However, there are relatively few exotic species that appear to have the capacity to displace native species without mechanical disturbance, although a notable exception is *Phyla canescens* in the flood-prone habitat. Moderate domestic stock grazing is compatible with nature conservation on the Darling Downs, although it is demonstrated that a proportion of the flora is sensitive to grazing. Remnants will need to be managed under a range of grazing regimes, including light total grazing pressure that excludes domestic stock to ensure the survival of the full range of species.

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957. Grazing and management of saltland shrubs.

Malcolm, C. V. and Pol, J. E.

Journal of Agriculture, Western Australia 27(2): 59-63. (1986)

NAL Call #: 23 W52J; ISSN: 0021-8618

Descriptors: woody plants/ grazing/ sheep/ range management/ *Atriplex*/ *Maireana*/ halophytes/ salt tolerance/ Western Australia

This citation is from AGRICOLA.

958. Grazing as a control against 'grass-encroachment' in dry dune grasslands in the Netherlands.

Kooijman, A. M. and Van Der Meulen, F.

Landscape and Urban Planning 34(3-4): 323-333. (1996)

NAL Call #: QH75.A1L32; ISSN: 0169-2046

Descriptors: conservation/ dry dune grassland/ field method/ grass encroachment/ grazing/ habitat/ species richness

Abstract: A study in dune grasslands in two Dutch coastal dune areas suggests that 'grass-encroachment', the dominance of a few tall grass species in formerly open, species-rich dune grasslands in the Netherlands, results in a loss of species, notably therophytes, bryophytes and lichens, as well as a strong reduction of the availability of daylight at the ground floor. Grazing with cattle and ponies as a control against 'grass-encroachment' has been studied in two coastal dune areas. Grazing with shetland ponies in 'de Zepeduinen' began in 1983. Aerial photographs of 1978, 1988 and 1993 were compared. After an initial increase in tall grass communities in both the valleys and the elevated dune ridges (8-20%) at the expense of more open vegetation, the photographs of 10 years of grazing revealed a decrease of tall grass cover (7-8%) and an increase of low grassland communities (4-5%). Grazing experiments in 'het Zwanenwater' started in parts of the area in 1984 and 1989. Comparison of vegetation maps of 1986 and 1992 revealed that tall grass cover increased over this period in the grazed areas (from 1-4% to 21-26%), but open communities were still prevalent (38-53%). In the non-grazed area, open communities declined dramatically (from 77% to 17%) and tall grass cover increased accordingly (from 3% to 53%). These preliminary results suggest that the present grazing regimes are perhaps not sufficient to stop grass-encroachment completely, but grazing seems a reasonably effective tool of management in terms of vegetation structure.

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959. Grazing as a tool for rangeland management in semiarid regions: A case study in the north-western coastal zone of Egypt.

Duivenbooden, N. van

Agriculture, Ecosystems & Environment 43(3/4): 309-324. (1993)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: range management

Abstract: Subshrubs are the dominant plant type of rangeland in the north-western coastal zone of Egypt. As animal husbandry depends to a large extent on this feed source, effects of grazing on plant growth were investigated. Experimental results showed that grazing extends the growing period of subshrubs. The mechanism underlying this phenomenon is lower water use by the plants in the rainy season and the consequent higher availability in the dry season. Owing to the characteristic growth form of the subshrubs, leaves are protected inside their dense structure, ensuring plant growth while grazing takes place. Simulations suggested that water storage in deeper soil layers is a function of grazing intensity and annual precipitation. It is suggested that a considerable grazing pressure is necessary to maintain the rangeland. Regeneration of the rangeland is a problem and physical removal (firewood) is a greater danger to its persistence than is grazing.

This citation is from AGRICOLA.

960. Grazing, ecological condition and biodiversity in riparian river red gum forests in south-eastern Australia.

Jansen, A. and Robertson, A. I.

Proceedings of the Royal Society of Victoria 117(1): 85-95. (2005); ISSN: 0035-9211

Descriptors: birds/ ecological condition/ frogs/ plants/ riparian grazing

Abstract: The ecological condition of riparian habitats and the biodiversity of terrestrial birds, wetland frogs and herbaceous plants were surveyed in river red gum habitats on the Murrumbidgee and Murray Rivers. Sites were classified according to the intensity of grazing by domestic livestock: ungrazed; low grazing (<5 DSE/ha/annum); and high grazing (>5 DSE/ha/annum). Declines in the ecological condition of riparian habitats and loss of biodiversity of birds, frogs and plants were clearly associated with increased grazing intensity in river red gum habitats. Riparian condition differed significantly between all three levels of grazing, while bird, frog and plant communities differed significantly between high and low grazing intensities. Loss of woodland-dependent and threatened species of birds, fewer occurrences of tadpoles and the loss of several functional groups of native plants were also related to increases in grazing intensity. Exotic grasses were more abundant in low grazed sites than in ungrazed sites. While it is clear that grazing has had significant impacts on riparian function and biodiversity, it is not clear whether these impacts can be reversed to fully restore riparian river red gum habitats. To achieve full restoration of riparian function and biodiversity may require not only fencing to exclude stock or significantly reduce stocking rates, but also replanting of trees, shrubs and understorey, as well as on-going control of exotic species and restoration of more natural flooding regimes.
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961. Grazing ecology and the conservation of heather moorland: The development of models as aids to management.

Grant, S. A. and Armstrong, H. M.

Biodiversity and Conservation 2(1): 79-94. (1993)

NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: Calluna vulgaris/ grazing/ overgrazing/ sheep/ feeding preferences/ environmental degradation/ United Kingdom
This citation is from AGRICOLA.

962. Grazing effect on diversity of annual plant communities in a semi-arid rangeland: Interactions with small-scale spatial and temporal variation in primary productivity.

Osem, Y.; Perevolotsky, A.; and Kigel, J.

Journal of Ecology 90(6): 936-946. (2002)

NAL Call #: 450 J829; ISSN: 0022-0477

Descriptors: competition/ disturbance/ Mediterranean sheep/ species richness

Abstract: 1. The interactive effect of grazing and small-scale variation in primary productivity on the diversity of an annual plant community was studied in a semiarid Mediterranean rangeland in Israel over 4 years. The response of the community to protection from sheep grazing by fenced enclosures was compared in four neighbouring topographic sites (south- and north-facing slopes, hilltop and wadi (dry stream) shoulders), differing in

vegetation, physical characteristics and soil resources. The herbaceous annual vegetation was highly diverse, including 128 species. Average small-scale species richness of annuals ranged between 5 and 16 species within a 20 × 20 cm quadrat, and was strongly affected by year and site. 2. Above-ground potential productivity at peak season (i.e. in fenced subplots) was typical of semiarid ecosystems (10-200 g m⁻²), except on wadi shoulders (up to 700 g m⁻²), where it reached the range of subhumid grassland ecosystems. Grazing increased richness in the high productivity site (i.e. wadi), but did not affect, or reduced, it in the low productivity sites (south- and north-facing slopes, hilltop). Under grazing, species richness was positively and linearly related to potential productivity along the whole range of productivity. Without grazing, this relationship was observed only at low productivity (< 200 g m⁻²). 3. The effect of grazing along the productivity gradient on different components of richness was analysed. At low productivity, number of abundant, common and rare species all tended to increase with productivity, both with and without grazing. Rare species increased three times compared with common and abundant species. At high productivity, only rare species continued to increase with productivity under grazing, while in the absence of grazing species number in the different abundance groups was not related to productivity. 4. In this semiarid Mediterranean rangeland, diversity of the annual plant community is determined by the interaction between grazing and small-scale spatial and temporal variation in primary productivity, operating mainly on the less abundant species in the community.
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963. Grazing effects on germinable seeds on the fescue prairie.

Willms, W. D. and Quinton, D. A.

Journal of Range Management 48(5): 423-430. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/485/423-430_willms.pdf

Descriptors: prairies/ grazing intensity/ seed germination/ seasonal variation/ botanical composition/ prairie soils/ stocking rate/ grazing/ Festuca campestris/ Alberta
Abstract: The germinable seed bank in a grassland affects the succession of degraded range and the recolonization of disturbed sites, and must be understood to predict potential responses to management. The germinable seed bank on the fescue prairie was characterized and its relationship to grazing, season, and depth of burial determined. The study was conducted in the fescue prairie of southwestern Alberta in livestock enclosures and on paddocks that, since 1949, have been stocked at fixed rates to achieve light, moderate, or heavy grazing pressures. Surface debris was sampled in fall and spring, and soil was sampled to a depth of 6 cm in spring. The samples were spread on vermiculite in trays and the seeds allowed to germinate over a 90-day period. In fall, total surface seed numbers m⁻² increased from 1,785 to 7,783 from the ungrazed to heavily grazed site, and most of the differences were accounted for by whitlowgrass (*Draba* spp.) and Kentucky bluegrass (*Poa pratensis* L.). These species also contributed most to differences between fall and spring on the grazed sites. Total seed numbers were similar (1,790 vs 1,803) in spring and fall on ungrazed sites. The species composition of the seed bank did not change with depth. In the soil, the annual forb pygmyflower (*Androsace septentrionalis* L.) was the most

common seed but was not detected in a vegetation survey. Soil disturbance in the fescue prairie is more likely to lead to a seral community dominated by annual forbs, than a rough fescue (*Festuca campestris* Rydb.) dominated grassland.

This citation is from AGRICOLA.

964. Grazing effects on plant cover, soil and microclimate in fragmented woodlands in south-western Australia: Implications for restoration.

Yates, Colin J.; Norton, David A.; and Hobbs, Richard J. *Austral Ecology* 25(1): 36-47. (2000)

NAL Call #: QH540 .A8; ISSN: 1442-9985

Descriptors: grazing effects: microclimate, plant cover, soil woodlands: fragmentation, restoration

Abstract: This study investigated the impacts of livestock grazing on native plant species cover, litter cover, soil surface condition, surface soil physical and chemical properties, surface soil hydrology, and near ground and soil microclimate in remnant *Eucalyptus salmonophloia* F. Muell woodlands. Vegetation and soil surveys were undertaken in three woodlands with a history of regular grazing and in three woodlands with a history of little or no grazing. Livestock grazing was associated with a decline in native perennial cover and an increase in exotic annual cover, reduced litter cover, reduced soil cryptogam cover, loss of surface soil microtopography, increased erosion, changes in the concentrations of soil nutrients, degradation of surface soil structure, reduced soil water infiltration rates and changes in near ground and soil microclimate. The results suggest that livestock grazing changes woodland conditions and disrupts the resource regulatory processes that maintain the natural biological array in *E. salmonophloia* woodlands. Consequently the conditions and resources in many remnant woodlands may be above or below critical thresholds for many species. The implications of these findings for restoration of plant species diversity and community structure are discussed. Simply removing livestock from degraded woodlands is unlikely to result in the restoration of plant species diversity and community structure. Restoration will require strategies that capture resources, increase their retention and improve microclimate.

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965. Grazing effects on species balance and herbage production in indigenous plant communities.

Grant, S. A. and Hodgson, J.

Nato Advanced Science Institutes Series: Series A: Life Sciences 108: 69-77. (1986)

NAL Call #: QH301.N32

Descriptors: grazing/ forage crops/ cattle/ sheep/ seasonal variation/ Scotland

This citation is from AGRICOLA.

966. Grazing effects on spring ecosystem vegetation of California's hardwood rangelands.

Allen-Diaz, B. and Jackson, R. D.

Journal of Range Management 53(2): 215-220. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/532/215-220_allen.pdf

Descriptors: cattle/ body weight/ grazing/ species diversity/ botanical composition/ plant communities/ springs (water)/ riparian buffers/ plant litter/ highlands/ California

Abstract: Three watersheds at the University of California's Sierra Foothill Research and Extension Center (SFREC), Marysville, Calif. were selected to study cattle grazing effects on the vegetation surrounding cold-water springs and their downslope creeks. Three spring-creek systems from each of 3 watersheds were randomly assigned to grazing treatments (9 total). Treatments were ungrazed, lightly grazed (1,500 kg(.)ha(-1) residual dry matter), and moderately grazed (1,000 kg(.)ha(-1) residual dry matter) based on degree of use in upland pastures encircling the spring-creek systems. Total herbaceous cover at springs varied significantly among the 6 years only once (greater in 1994 than all others covarying with previous year's rainfall). Grazing intensity did not affect total herbaceous cover at springs. A year X grazing treatment interaction ($P < 0.05$) was detected for total herbaceous cover at spring-fed creeks. Three years after grazing removal, total herbaceous cover on ungrazed creek plots surpassed cover at moderately grazed and lightly grazed plots. Moderately grazed plot herbaceous cover declined steadily throughout the first 3 years, while lightly grazed cover remained relatively stable. Plant community composition and stability by year and grazing treatment were analyzed with TWINSpan. With few exceptions, stable plant communities persisted on sites regardless of grazing intensity or cover changes. Total herbaceous cover was sensitive to interannual fluctuations, especially under increased grazing intensities. This attribute renders cover a more useful gauge of ecosystem health than plant composition as the latter may not provide evidence of potentially deleterious grazing X climate interactions until after soil erosion or water table characteristics are seriously, perhaps permanently, altered.

This citation is from AGRICOLA.

967. Grazing effects on sustainable semiarid rangelands in Patagonia: The state and dynamics of the soil seed bank.

Bertiller, Monica B.

Environmental Management 20(1): 123-132. (1996)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: grazing exclusion/ land management

Abstract: The composition of the germinable seed bank was studied in four vegetation states of the *Festuca pallescens* grasslands in semiarid Patagonia during four years. The aim of this study was to test whether aboveground vegetation states resulting from grazing exclusion or different combinations of grazing and topography are reflected in different states of the germinable seed bank. The size of the total and dicot germinable seed bank was positively related to the total cover in each state. Dicots dominated all germinable seed bank states. *Carex patagonica* increased its cover as well as its germinable seed bank under grazing disturbance. Grazing did not reduce the germinable seed bank of perennial grasses in uplands where the grazing pressure is lower as compared with slopes. In slopes the germinable seed bank of perennial grasses was significantly reduced by grazing. A reduction of the length of the grazing period in late spring increases the germinable seed bank of perennial grasses both in upland and slope. These results are interpreted in the frame of a model of management techniques where grazing exclusion during late spring and late summer increases the seed bank of the perennial grasses and promotes their establishment in uplands. The

artificial addition of seeds of perennial grasses and the manipulation of the soil surface in order to increase "safe sites" appear as management alternatives that deserve further evaluation to improve plant reestablishment in slopes.

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968. Grazing, environmental heterogeneity, and alien plant invasions in temperate Pampa grasslands.

Chaneton, Enrique J.; Perelman, Susana B.; Omacini, Marina; and Leon, Rolando J. C.

Biological Invasions 4(1-2): 7-24. (2002)

NAL Call #: QH353 .B563; ISSN: 1387-3547

Descriptors: anthropogenic disturbance/ biological invasions/ environmental fluctuation/ environmental heterogeneity/ enclosure experiments/ flooding/ grazing behavior/ herbivory/ landscape ecology/ salinity stress/ soil fertility gradients/ species composition/ species diversity/ species richness/ temperate humid grasslands: habitat/ vegetation surveys

Abstract: Temperate humid grasslands are known to be particularly vulnerable to invasion by alien plant species when grazed by domestic livestock. The Flooding Pampa grasslands in eastern Argentina represent a well-documented case of a regional flora that has been extensively modified by anthropogenic disturbances and massive invasions over recent centuries. Here, we synthesise evidence from region-wide vegetation surveys and long-term enclosure experiments in the Flooding Pampa to examine the response of exotic and native plant richness to environmental heterogeneity, and to evaluate grazing effects on species composition and diversity at landscape and local community scales. Total plant richness showed a unimodal distribution along a composite stress/fertility gradient ranging several plant community types. On average, more exotic species occurred in intermediate fertility habitats that also contained the highest richness of resident native plants. Exotic plant richness was thus positively correlated with native species richness across a broad range of flood-prone grasslands. The notion that native plant diversity decreases invasibility was supported only for a limited range of species-rich communities in habitats where soil salinity stress and flooding were unimportant. We found that grazing promoted exotic plant invasions and generally enhanced community richness, whereas it reduced the compositional and functional heterogeneity of vegetation at the landscape scale. Hence, grazing effects on plant heterogeneity were scale-dependent. In addition, our results show that environmental fluctuations and physical disturbances such as large floods in the pampas may constrain, rather than encourage, exotic species in grazed grasslands.

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969. Grazing for environmental benefits.

Bullock, D. J. and Armstrong, H. M.

In: *Grazing Management*. (Held 2 Feb 1929-2 Mar 2000 at Harrogate, United Kingdom.) Rook, A. J. and Penning, P. D. (eds.); pp. 191-200; 2000.

NAL Call #: SB197.B7; ISBN: 0905944542

970. Grazing frequency and ecosystem processes in a northern mixed prairie, USA.

Biondini, M. E. and Manske, L.

Ecological Applications 6(1): 239-256. (1996)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: grazing/ frequency/ nutrient uptake/ grasslands/ prairies/ grazing systems/ grazing intensity/ botanical composition/ stocking rate/ mineral uptake/ nitrogen

Abstract: The effects of a twice-over rotation grazing system (ROT) and a season-long grazing system (SL) with cow/calf pairs were evaluated over a 6-year period at the Ranch Headquarters of the North Dakota State University Dickinson Research Center, to compare these effects with long-term grazing exclosures (NG) in terms of species composition and basal cover, aboveground net primary production (ANPP) and aboveground N uptake (ANPP-N), rates of litter and root decomposition, N release, soil N mineralization and immobilization, aboveground C and N flow, grazing intensity (GI) and animal performance. The study period included the drought of 1988. The prairie community was dominated by grasses such as *Agropyron smithii* [*Elymus smithii*], *Koeleria cristata* and *Stipa* sp. and associated with these species were species such as *Bouteloua gracilis*, *Carex filifolia* and *Carex heliophila*. No major differences were found in ANPP and ANPP-N between treatments, but there were important seasonal variations. An average of 72% of ANPP and >82% of ANPP-N occurred by mid-June. No differences were observed among treatments in terms of decomposition and N release rates from litter and root biomass, or in soil N mineralization. Grazing, however, reduced the amount of C and N immobilized in standing dead and litter and the flow of C and N from standing dead to litter to soil organic matter. The NG and ROT treatment were more similar in this regard when compared to the SL treatment, and their similarities increased after the drought of 1988. No consistent differences in GI between the ROT and SL treatments were observed. Before 1988 GI averaged 21% but in 1988 and 1989 GI increased to an average of 49% as a result of the drought and its after-effects. Cumulative animal performance was similar under both grazing treatments but with significant seasonal variations. Species composition was more responsive to grazing than were C and N flows. Differences were found between the grazed and NG treatments but not between the 2 grazing treatments studied. No broad patterns of change in total plant basal cover were observed as a result of grazing patterns or drought. Changes in species composition were highly dependent on range site, the most consistent pattern involving *B. gracilis* which had higher relative cover in the grazed treatments than in the NG treatment. It is suggested that in the grasslands of western North Dakota the recommended stocking rate may be too conservative, that rotational grazing may allow for higher stocking rates than season-long grazing without a major impact on animal performance, that rainfall is more important than grazing or grazing systems in the control of the ecosystem-level variables measured, and that species composition is affected by drought and grazing (but not by grazing systems) and are highly dependent on range site. It is concluded that drought and grazing tend to increase the relative proportions of warm-season grasses and forbs in the sward.

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971. Grazing impacts on infiltration in mixed prairie and fescue grassland ecosystems of Alberta.

Naeth, M. A.; Rothwell, R. L.; Chanasyk, D. S.; and Bailey, A. W.

Canadian Journal of Soil Science 70(4): 593-606. (1990)

NAL Call #: 56.8 C162; ISSN: 0008-4271

Descriptors: range condition/ compaction/ soil structure/ vegetation/ litter removal

Abstract: Infiltration capacity is generally reduced with increased grazing intensity and reduced range condition, mainly through vegetation and litter removal, solid structure deterioration, and compaction. Only one study has documented the effect of grazing on Canadian rangelands, necessitating further investigation. In this study, impact of long-term grazing on infiltration were assessed in mixed prairie and fescue grassland ecosystems of southern and central Alberta, Canada. Grazing regimes were of light to very heavy intensities, grazed early, late, and continuously during the growing season. Ungrazed controls were evaluated at each site. Infiltration was measured with double ring infiltrometers. Heavy intensity and/or early season grazing had greater impact on infiltration than light intensity and/or late season grazing. In mixed prairie, initial and steady state infiltration rates in the control were 1.5 and 1.7 times higher, respectively, than those in the early season grazed treatment. In parkland fescue, initial rates were lowest in June grazed treatments and steady state rates were highest in light autumn grazed and control treatments. Initial infiltration rates in foothills fescue control and light grazed treatments were 1.5-2.3 times those in heavy and very heavy grazed treatments. Steady state rates were 1.5-2 times higher in light grazed and control treatments than in moderate, heavy, and very heavy grazed treatments.

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972. Grazing impacts on litter and roots: Perennial versus annual grasses.

Mapfumo, E.; Naeth, M. A.; Baron, V. S.; Dick, A. C.; and Chanasyk, D. S.

Journal of Range Management 55(1): 16-22. (2002)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: Bromus inermis/ Bromus riparius/ triticale/ perennials/ annuals/ grazing intensity/ soil chemistry/ chemical composition/ carbon/ nitrogen/ root systems/ roots/ weight/ autumn/ spring/ seasonal variation/ plant litter/ Alberta

Abstract: Soil carbon (C) and nitrogen (N) storage in grasslands is a function of litter and root mass production. Research on how annual grasses compare with perennials for above ground and below ground mass production, and contributions to the soil C pool under pasture management is scarce. The objective of this research was to evaluate grazing intensity effects on litter and root mass, C and N pools of perennial grasses, smooth brome grass (*Bromus inermis* L.) and meadow brome grass (*Bromus riparius* Rhem.), and the annual grass, winter triticale (*X Triticosecale* Wittmack). Litter mass and C pool for the perennial grasses were greater than those for triticale. Litter C and N pools generally decreased with increased grazing intensity. Root mass was greater for the perennial grasses than for triticale at all grazing intensities. Meadow brome grass generally produced more root mass than smooth brome grass. Root C and N pools for triticale were 31 and 27%, respectively, of that for the perennial grasses.

Estimated total C contribution (roots and litter) to the resistant soil organic C pool was 1.5 times greater for light compared to heavy grazing. Total C (litter + root) contribution for perennial grasses was 2.7 times greater than that for triticale. Perennial grasses provided a larger litter base and root system that promote greater storage of C in the soil compared with triticale. This citation is from AGRICOLA.

973. Grazing impacts on litter and soil organic matter in mixed prairie and fescue grassland ecosystems of Alberta.

Naeth, M. A.; Bailey, A. W.; Pluth, D. J.; Chanasyk, D. S.; and Hardin, R. T.

Journal of Range Management 44(1): 7-12. (1991)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/441/2naet.pdf>

Descriptors: cattle/ grazing intensity/ prairies/ Festuca/ soil organic matter/ grazing/ plant litter/ Alberta

This citation is from AGRICOLA.

974. Grazing induced biodiversity in the highland ecozone of East Africa.

Woldu, Zerihun and Mohammed Saleem, M. A.

Agriculture, Ecosystems & Environment 79(1): 43-52. (2000)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: biodiversity induction/ grassland/ grazing intensity/ life forms/ manure management practices/ rainfall pattern/ seed bank/ seed germination/ soil fertility/ species composition/ vegetation composition

Abstract: The species composition of grazing lands can be influenced by livestock and grazing pressure. A study on manure seed bank was conducted in Ghinchi highland Research Site in Ethiopia between 1995 and 1997. The data on species composition and life-form of the plants germinating in pots receiving air dried manure were compared with species composition of experimental plots in natural grassland subjected to varying grazing intensity. There was significant difference among the species composition of grazed and non-grazed grasslands and the manure seed bank ($p = 0.01$). The life-forms of the species also showed variation. There were more families and species in the natural grassland vegetation than indicated in the manure seed bank. The manure seed bank had more annuals than the natural grassland vegetation. The species composition and life-forms in the manure seed bank showed variation with time and this corresponded with the seasonal variation in the grassland, which had a direct relationship with the rainfall pattern. The study showed that livestock play a major role in maintaining the biodiversity of grassland vegetation by spatial and temporal dispersion of readily germinating seeds in their manure. The use of manure to improve soil fertility should be weighed cautiously against the introduction of weeds into crop fields, although weeds are important feed resource for livestock in land-constrained areas. There is therefore the need for developing manure management practices so that the benefits can be optimised and the undesirable effects can be minimised.

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975. Grazing influences on watering point vegetation in the Chihuahuan desert.

Fusco, M.; Holechek, J.; Tembo, A.; Daniel, A.; and Cardenas, M.

Journal of Range Management 48(1): 32-38. (1995)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1995/481/032-038_fusco.pdf

Descriptors: cattle/ drinking water/ range management/ stocking rate/ botanical composition/ poisonous plants/ arid zones/ New Mexico

Abstract: Long-term influences of livestock grazing on vegetation around watering points was studied on 2 upland Chihuahuan desert ranges in southcentral New Mexico using regression analysis. One range had been conservatively stocked since the 1950's while the other was more heavily stocked. About 45% of the climax vegetation occurred on the heavily stocked range compared to 70% on the conservatively stocked range. During 3 years of study, both ranges were stocked conservatively so annual utilization of the key forage grasses was 30-35%.

Regression analyses showed black grama (*Bouteloua eriopoda* Torr.), mesa dropseed (*Sporobolus flexuosus* Thurb, Rybd.), threeawn (*Aristida* sp.), and total perennial grass standing crop increased as distance from water increased on the good condition range ($P < 0.05$).

However, black grama and threeawn standing crop showed no association with distance from water on the fair condition range. Broom snakeweed (*Xanthocephalum sarothrae* Pursh.), the primary poisonous plant found on both ranges, was associated ($r^2 = 0.35$) with distance from water only on the good condition range in April. Poisonous plants other than broom snakeweed decreased as distance from water increased with the exception of the fair condition range in October. No livestock losses from poisonous plants were noted on either range over the 3 years. We attribute this to the present conservative stocking rates. Our study supports the recommendation that downward stocking rate adjustments be made for the zone more than 1,600 m from water.

This citation is from AGRICOLA.

976. Grazing intensity, aspect, and slope effects on limestone grassland structure.

Amezaga, I.; Mendarte, S.; Albizu, I.; Besga, G.; Garbisu, C.; and Onaindia, M.

Journal of Range Management 57(6): 606-612. (Nov. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: botanical composition/ forage quality/ Spain

Abstract: Three treatments were used to evaluate the effect of grazing intensity (ca 30% and 50% herbage removal), aspect (north and south), and slope (< 10% and 10%-30%) on plant community structure of mountain grasslands in the Basque Country (Spain). Plant species richness was not significantly affected by grazing intensity, aspect, or slope. Although plant species composition was similar (Sorensen's similarity index = 0.87) between both grazing intensities, species frequency and cover were affected by grazing intensity. *Festuca rubra* L. and *Agrostis capillaris* L. were the most common species under both grazing pressures. Moderate grazing intensity (50% herbage removal) plots contained a greater number of plant species with a frequency of more than 50%. The lowest cover for *F. rubra* corresponded to low grazing intensity, north aspects, and steeper slopes. The lowest cover for *A.*

capillaris was found under low grazing intensity (30% herbage removal) and steeper slopes. *Danthonia decumbens* (L.) P. C., *Potentilla erecta* (L.) Rauschal, and *Trifolium repens* L. were significantly affected by aspect and grazing intensity. Low grazing intensity on sites with northern aspects and steep slopes favored *Agrostis curtisii* Kerguelen, a species with a low nutritional value. *A. capillaris*, *A. curtisii*, *P. erecta*, and *T. repens* were sensitive to soil properties and aspect. Nitrogen and K soil concentrations were significantly higher in areas with low grazing intensity, most likely due to greater dead herbage accumulation. Significant ($P < 0.05$) correlations between plant species and soil pH or P concentration were found in areas with low grazing intensity. Reduction in grazing intensity together with the effect of slope and northern aspect has resulted in changes in plant community structure, leading to increases in forages with lower nutritional value.

This citation is from AGRICOLA.

977. Grazing intensity effects on litter decomposition and soil nitrogen mineralization.

Shariff, A. R.; Biondini, M. E.; and Grygiel, C. E.

Journal of Range Management 47(6): 444-449. (1994)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1994/476/5shar.pdf>

Descriptors: grasses/ grazing intensity/ rangelands/ biogeochemical cycles/ degradation/ rangeland soils/ plant litter/ North Dakota

Abstract: A 2 year study in south central North Dakota determined the responses of (1) litter and root decomposition and nitrogen (N) release, and (2) soil N mineralization to grazing intensity. The treatments were: long term not grazed, moderate grazing, and heavy grazing. The moderate grazing and the heavy grazing treatments removed 45% and 77% of annual above-ground growth respectively. The moderate grazing treatment resulted in higher decomposition and soil N mineralization rates, and lower N releases via decomposition than the long term not grazed and heavy grazing treatments. No consistent differences were found between the long term not grazed and heavy grazing treatments. Annual litter and root decomposition rates in the moderate grazing treatment averaged 55% for 1989-1990 and 63% for 1990-1991 while the long term not grazed and heavy grazing treatments had rates for the same periods of 13% and 19%. The moderate grazing treatment had a net soil N mineralization of 60 micrograms.g⁻¹ and 269 micrograms.g⁻¹ during the 1989 and 1990 growing seasons whereas the long term not grazed and heavy grazing treatments had net soil immobilization for the same periods of -59 micrograms.g⁻¹ and -115 micrograms.g⁻¹. Annual N release from litter and root decomposition in the heavy grazing and long term not grazed treatments averaged 70% and 38% respectively during the 1989-1990 incubation period, and 51 % and 23% during 1990-1991. The equivalent values for the moderate grazing treatment were 47% and -6% (net N immobilization) for 1989-1990 and 41% and 23% for 1990-1991. Results from this study seem to indicate that the standard grazing rule of "take half leave half" may have a significant impact in N conservation and the supply of mineral N for plant growth.

This citation is from AGRICOLA.

978. Grazing intensity on the plant diversity of alpine meadow in the eastern Tibetan plateau.

Wu Ning; Liu Jian; and Yan ZhaoLi

Rangifer (Special Issue 15): 9-15. (2004)

NAL Call #: QL737.U55R341; ISSN: 0801-6399

Descriptors: alpine grasslands/ biodiversity/ environmental degradation/ grasslands/ grazing/ grazing systems/ high altitude/ rangelands/ seasonal variation/ seasons/ species diversity/ Kobresia pygmaea

Abstract: Because of the remoteness and harsh conditions of the high-altitude rangelands on the eastern Tibetan Plateau, the relationship between yak grazing and plant diversity has not been so clear although livestock increase was thought as the main issue leading to the degradation of rangeland. In the debate of rangeland degradation, biodiversity loss has been assumed as one of the indicators in the last two decades. In this paper authors measured the effects of different grazing intensities on the plant diversity and the structure of *Kobresia pygmaea* community in the case-study area, northwestern Sichuan. The results indicated that plant diversity of alpine meadow has different changing trends respectively with the change of grazing intensity and seasons. In June the highest plant diversity occurred in the intensively grazed (HG) plots, but in July and September species biodiversity index of slightly grazed (LG) plots is higher than other experimental treatments. In August the intermediate grazed (IG) plots has the highest biodiversity index. Moreover, it was found that intensively grazing always leads to the increase of plant density but meanwhile the decrease of community height, coverage and biomass. Over-grazing can change the community structure and lead to the succession from *Kobresia pygmaea* dominated community to *Poa pratensis* dominated. Analysing results comprehensively, it can be suggested that the relationship between grazing intensity and plant diversity is not linear, i.e. diversity index is not as good as other characteristics of community structure to evaluate rangeland degradation on the high altitude situation. The change of biodiversity is so complicated that it can not be explained with the simple corresponding causality.

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979. Grazing management effects on plant species diversity in tallgrass prairie.

Hickman, K. R.; Hartnett, D. C.; Cochran, R. C.; and Owensby, C. E.

Journal of Range Management 57(1): 58-65. (Jan. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: cattle/ stocking rate/ grazing intensity/ rotational grazing/ botanical composition/ plant communities/ prairies/ C4 plants/ plant architecture/ spatial distribution/ endemic species/ perennials/ forbs/ annuals/ prescribed burning/ range management/ Kansas

Abstract: A 6-year study was conducted in tallgrass prairie to assess the effects of grazing management (cattle stocking densities and grazing systems) on plant community composition and diversity. Treatments included sites grazed season-long (May to October) at 3 stocking densities (3.8, 2.8, and 1.8 hectares per animal unit), ungrazed control sites, and sites under a late-season rest rotation grazing system at this same range of stocking densities. Plant communities were sampled twice each season using a nearest-point procedure. Native plant species diversity, species richness, and growth form

diversity were significantly higher in grazed compared to ungrazed prairie, and diversity was greatest at the highest stocking density. This enhancement of plant species diversity under grazing was not a result of increased frequency of weedy/exotic species. There were no significant effects of grazing system on plant diversity, nor any significant stocking density x grazing system interactions, indicating that animal density is a key management variable influencing plant species diversity and composition in tallgrass prairie and that effects of animal density override effects of grazing systems. Increasing cattle stocking densities decreased the abundance of the dominant perennial tall grasses, and increased abundance of the C4 perennial mid-grasses. The frequency of perennial forbs was relatively stable across grazing treatments. Abundance of annual forbs varied among years and grazing treatments. In half of the years sampled, annual forbs showed the highest frequency under intermediate stocking density. Patterns of responses among plant groups suggest that some species may respond principally to direct effects of grazers and others may respond to indirect effects of grazers on competitive relationships or on the spatial patterns of fuel loads and fires. Thus, this study suggests that large grazer densities, fire, and annual climatic variability interact to influence patterns of plant community composition and diversity in tallgrass prairie. Effects of varying management such as stocking densities and grazing systems on plant species diversity and the relative abundances of different plant growth forms or functional groups may have important consequences for grassland community stability and ecosystem function.

This citation is from AGRICOLA.

980. Grazing management for riparian-wetland areas.

Leonard, S. G.; National Applied Resource Sciences Center (U. S.); and United States. Forest Service. Denver, Colo.: U.S. Dept. of the Interior, Bureau of Land Management, National Applied Resource Sciences Center, 1997. 63 p. Riparian area management.

Notes: "U.S. Department of Agriculture, Forest Service"--Cover. Shipping list no.: 98-0126-P. "BLM/RS/ST-97/002+1737"--P. [2] of cover. Includes bibliographical references (p. 57-63). SUDOCs: I 53.35:1737-14.

NAL Call #: SF85.3.G75--1997

Descriptors: range management--United States/ grazing--environmental aspects--United States/ riparian ecology--United States/ wetland conservation--United States
This citation is from AGRICOLA.

981. Grazing management, resilience, and the dynamics of a fire-driven rangeland system.

Anderies, John M.; Janssen, Marco A.; and Walker, Brian H.

Ecosystems 5(1): 23-44. (2002)

NAL Call #: QH540 .E3645; ISSN: 1432-9840

Descriptors: fire dominated rangeland system/ fire driven rangeland system/ grazing/ grazing management/ grazing resilience/ grazing dominated rangeland system/ mathematical model/ shrub dominated rangeland system
Abstract: We developed a stylized mathematical model to explore the effects of physical, ecological, and economic factors on the resilience of a managed fire-driven rangeland system. Depending on grazing pressure, the model exhibits one of three distinct configurations: a fire-dominated,

grazing-dominated, or shrub-dominated rangeland system. Transaction costs and costs due to shrub invasion, via their effect on grazing decisions, strongly influence which stable configuration is occupied. This, in turn, determines the resilience of the rangeland system. These results are used to establish conditions under which management for profit is consistent with the maintenance of resilience.

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982. Grazing management strategies as a factor influencing ecological stability of Mongolian grasslands.

Sheehy, D. P.

Nomadic Peoples 33: 17-30. (1993)

NAL Call #: GN387.N594; ISSN: 0822-7942

Descriptors: grazing systems/ sustainability/ grassland management/ livestock/ grasslands/ steppes/ environmental degradation/ grazing

Abstract: Mongolian pastoral ecosystems have been grazed by domestic livestock for centuries. During this long history, livestock grazing had minimal impact on the long-term ecological stability of steppe ecosystems. However, the relatively recent imposition of sedentary agricultural production systems and changes in livestock grazing management strategies have seriously affected ecological stability of grazed ecosystems, especially in Inner Mongolia. Although ecosystem stability has been damaged in Mongolia, opportunities remain to implement grazing management strategies that support ecologically sustainable use by livestock. In Inner Mongolia, widespread ecological instability presents agricultural policy-makers and the livestock producer with little opportunity to use grazing management strategies in the livestock production system.

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983. Grazing management strategies for reseeded rangelands in the east Kimberley region of Western Australia.

Hacker, R. B. and Tunbridge, S. B.

Rangeland Journal 13(1): 14-35. (1991)

NAL Call #: SF85.4.A8A97; ISSN: 0313-4555

Descriptors: cattle/ range management/ *Cenchrus*/ introduced species/ *Enneapogon*/ environmental degradation/ botanical composition/ stocking rate/ regeneration/ liveweight gain/ grazing intensity/ dry season/ semiarid zones/ Western Australia

This citation is from AGRICOLA.

984. Grazing management: Technology for sustaining rangeland ecosystems?

Heitschmidt, R. K. and Walker, J. W.

Rangeland Journal 18(2): 194-215. (1996)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: stocking rate/ rain

This citation is from AGRICOLA.

985. Grazing strategies, stocking rates, and frequency and intensity of grazing on western wheatgrass and blue grama.

Hart, R. H.; Clapp, S.; and Test, P. S.

Journal of Range Management 46(2): 122-126. (1993)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1993/462/7hart.pdf>

Descriptors: *Bouteloua gracilis*/ *Pascopyrum smithii*/ botanical composition/ stocking rate/ steers/ grazing intensity/ rotational grazing/ defoliation/ forage/ tillers/ grazing

Abstract: Stocking rates and grazing strategies may alter botanical composition of rangeland vegetation by altering frequency and intensity of defoliation of individual plant species. We used long-interval time-lapse photography to study frequency and intensity of defoliation of western wheatgrass (*Pascopyrum smithii*[Rydb.] A. Love) and blue grama (*Bouteloua gracilis* [H.B.K.] Lag. ex Steud.) tillers under continuous season-long and time-controlled short-duration rotation grazing by steers at 2 stocking rates. Frequency, intensity, and variability of defoliation of both grasses were similar under both grazing systems. Western wheatgrass tillers were grazed more frequently under heavy than under moderate stocking, and in 1990 more herbage was removed the second time a tiller was grazed under heavy stocking. Blue grama tillers were grazed more frequently under heavy than under moderate stocking in both years under rotation grazing, but only in 1990 under continuous grazing; more herbage was removed under heavy stocking the second time a tiller was grazed. Under heavy and moderate stocking, respectively, 19% and 36% of western wheatgrass tillers and 42% and 54% of blue grama tillers were ungrazed throughout the grazing season. Few western wheatgrass tillers were grazed more than twice, and few blue grama tillers were grazed more than once. Stocking rates have much greater potential than grazing systems for altering frequency and intensity of defoliation and subsequent changes in botanical composition of range plant communities. Results of grazing studies support this conclusion.

This citation is from AGRICOLA.

986. Grazing systems on the Edwards Plateau of Texas: Are they worth the trouble? Soil and vegetation response.

Taylor, C. A.; Garza, N. E.; and Brooks, T. D.

Rangelands 15(2): 53-57. (1993)

NAL Call #: SF85.A1R32; ISSN: 0190-0528

Descriptors: grasslands/ rangelands/ grazing systems/ grazing/ deferred rotation grazing

Abstract: The effects of the 2 grazing systems in the Edwards Plateau, Texas, deferred-rotation and intensive grazing, on soils and vegetation are reviewed. Deferred-rotation grazing systems were better for soil hydrologic stability than intensive grazing and favoured growth of the short grasses. Short duration grazing at greater stocking rates reduced the midgrass (e.g. side-oats grama [*Bouteloua curtipendula*], cane bluestem [*Bothriochloa barbinodis*]) component of the vegetation. Midgrasses also helped to reduce soil erosion compared with the short grasses (eg common curlymesquite [*Hilaria belangeri*], red grama [*B. gracilis*]).

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987. Grazing systems, stocking rates, and cattle behavior in southeastern Wyoming.

Hepworth, K. W.; Test, P. S.; Hart, R. H.; Waggoner, J. W.; and Smith, M. A.

Journal of Range Management 44(3): 259-262. (1991)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/443/16hepw.pdf>

Descriptors: steers/ beef cattle/ grazing/ rotational grazing/ stocking rate/ grazing intensity/ liveweight gain/ Wyoming

Abstract: Grazing systems and stocking rates are used to influence livestock grazing behavior with the intent of improving livestock and vegetation performance. In 1982, a study was initiated to determine effects of continuous, rotationally deferred, and short-duration rotation grazing and moderate and heavy stocking rates on steer gains, range vegetation, and distance traveled by and activity patterns of steers. Steers were observed from dawn to dark on 12 dates during 1983, 1984, and 1985, and activity recorded every 15 minutes. Eight steers per treatment (system X stocking rate combination) per date were observed in 1983 and 1984, and 10 per treatment in 1985. In 1984 and 1985, map locations of all steers were recorded at the same times as activity, and distance traveled summed from distances between successive map locations. In 1984, activity of 3 steers per treatment was electronically monitored during darkness. Steers grazed approximately 8.6 hr per day during daylight and 1.6 hr during darkness. Steers grazed an average of 8.9 hr/day during daylight under moderate vs 8.1 hr under heavy stocking, but stocking rate interacted with date in 1984 and grazing system in 1985. Steers traveled farther under continuous than under short-duration rotation grazing at both stocking rates in 1984, but only at the high stocking rate in 1985. Steers had to travel farther to water in the continuous pastures, and may have had to cover a greater area in an effort to select a more desirable diet, particularly under heavy stocking. These differences were not reflected in differences in gain among stocking rates or grazing systems.

This citation is from AGRICOLA.

988. Growth and reproduction of grasses heavily grazed under rest-rotation management.

Eckert, R. E. and Spencer, J. S.

Journal of Range Management 40(2): 156-159. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/402/16eckepdf>

Descriptors: Festuca idahoensis/ Sitanion hystrix/ Artemisia tridentata wyomingensis/ Stipa thurberiana/ Agropyron spicatum

Abstract: This study evaluated the effects of heavy forage use in a rest-rotation grazing system on the basal-area growth and frequency of occurrence of native bunchgrasses from 1975 to 1984. None of these grasses increased in basal-area cover with brush competition or in basal-area cover or frequency without brush competition when subjected to periodic heavy grazing (65% utilization in June and 75% in July) during the growing season. When plants were protected from grazing, average basal-area cover increased for Idaho fescue [*Festuca idahoensis* Elmer] and squirreltail [*Sitanion hystrix* (Nutt.) J.G. Sm.] in a Wyoming big sagebrush [*Artemisia tridentata* wyomingensis Beetle]-Idaho fescue community type and for Thurber needlegrass [*Stipa thurberiana* Piper] in a Wyoming big sagebrush-bluebunch wheatgrass [*Agropyron spicatum*

(Pursh) Scribn. and Smith] community type. Average basal-area cover was unchanged for protected Thurber needlegrass plants in a Wyoming big sagebrush-Thurber needlegrass community type. Average basal-area cover of Thurber needlegrass plants in the same community type decreased when heavily grazed during the growing season in 1 year during the first 3 years of the study and with no grazing during the growing season in the last 4 years of the study. Bluebunch wheatgrass showed no differential response to grazing or protection. Results of this study strongly implicate periodic heavy grazing during the growing season as a primary cause of restricted basal-area growth and lack of reproduction. These results support the contention that such grazing pressure can prevent range improvement in an otherwise appropriate rotation grazing system.

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989. Growth and water and nitrate uptake patterns of grazed and ungrazed desert shrubs growing over a nitrate contamination plume.

Mckee, C.; Glenn, E. P.; Waugh, W. J.; Eastoe, C.;

Jordan, F.; and Nelson, S. G.

Journal of Arid Environments 64(1): 1-21. (2006)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: growth

Abstract: Two native desert shrubs were evaluated for their growth potential and water and nitrogen uptake patterns over a nitrate-contaminated aquifer at a former uranium ore-processing facility in northeastern Arizona. *Sarcobatus vermiculatus* and *Atriplex canescens* are obligate and facultative phreatophytes, respectively, that dominate the local desert plant community. The main questions we addressed were: (1) Are these shrubs able to use water or nitrogen from the alluvial aquifer? (2) If so, does grazing interfere with that ability of shrubs? (3) What would be the ideal strategy to take up N from the plume and prevent its expansion and recharge using shrubs? $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ isotope signatures from water in plant stem samples suggest that both species utilize mainly deep, stored soil water derived from winter rains for transpiration, rather than summer rains or plume water. $\delta^{15}\text{N}$ enrichment values were similar for leaves of plants growing on and off the plume and for soil and aquifer water samples, but nitrate-N levels in leaf tissues were five times higher in plants growing on the plume compared to off the plume, suggesting they may have derived at least part of their nitrogen from the contamination plume. Total leaf N was also higher for plants growing on the plume. Under present conditions, only about 5% of the area over the plume is vegetated. Plants protected from grazing inside enclosures increased in volume by 2-4-fold over three growing seasons. Transplants of *A. canescens*, protected from grazing and irrigated over the first summer, established readily and grew into large shrubs after 3 years. On the basis of this study, the shrub community could be increased to as high as 25% cover and could make a significant contribution to controlling recharge if the contaminated site was protected from grazing. The results suggest that deeply rooted desert shrubs can impact the subsoil water and nitrogen balance, and that this balance can be disrupted by land use practices such as overgrazing that degrade the vegetation cover. (c) 2005 Elsevier Ltd. All rights reserved.

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990. Has intensive grazing by domestic livestock degraded Mediterranean Basin rangeland?

Seligman, N. G. and Perevolotsky, A.
 In: Plant-animal interactions in Mediterranean-type rangelands/ Arianoutsou, Margarita and Groves, R. H.; Series: Tasks for Vegetation Science 31.
 Dordrecht: Kluwer Academic Publishers, 1994; pp. 93-103.
 Notes: ISSN: 0167-9406
 NAL Call #: QK1.T37
 Descriptors: plant communities/ vegetation/ rangelands/ habitats/ range management/ grazing/ literature reviews/ Mediterranean region
 This citation is from AGRICOLA.

991. Heavy stocking and early-season deferment of grazing on Mediterranean-type grassland.

Gutman, M.; Holzer, Z.; Baram, H.; Noy-Meir, I.; and Seligman, N. G.
Journal of Range Management 52(6): 590-599. (1999)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1999/526/590-599_gutman.pdf
 Descriptors: beef cows/ grazing/ Mediterranean climate/ stocking rate/ feed supplements/ poultry manure/ range management/ duration/ biomass/ feed intake/ energy intake/ calving rate/ replacement rate/ production costs/ weaning weight/ Israel
 Abstract: An experiment with beef cows grazing Mediterranean-type grassland was conducted to study the effect of grazing deferment at the beginning of the growing season on pasture productivity and animal performance under intensive herd management conditions. The grazing trial was composed of 4 treatments (deferred grazing at stocking rates of 0.83 and 0.67 cows per ha and continuous grazing at 0.67 and 0.5 cows per ha) replicated in 2 blocks and continued for 5 consecutive years. The herds were given low-energy supplemental feed during deferment and during the dry summer. At the intermediate stocking rate, at which both deferred and continuous grazing were compared, herbage production was significantly reduced by grazing during the 'deferment period' and calf weaning weights without deferment were significantly lower than in the deferred grazing treatments. Weaned live weight per cow was significantly lowest in the continuous intermediate treatment. Weaned weight per hectare was greatest at the highest stocking rate (with deferment). Utilization of supplementary feed per unit weaned live weight was significantly greater in the deferred treatments. Only about a third of the herbage production was grazed, even at the heavy stocking rates. Herbage production varied more between years than between treatments. It is concluded that in the system studied, deferment with supplementary feeding becomes important for both animal and vegetation production as stocking rate approaches and exceeds 0.67 cows ha⁻¹. With deferment, herbage production during the main growing season can be maintained even under heavy grazing pressure. This result can be explained with a simple dynamic growth and grazing model.
 This citation is from AGRICOLA.

992. Herbage production of Mediterranean grassland under seasonal and yearlong grazing systems.

Gutman, M.; Seligman, N. G.; and Noy-Meir, I.
Journal of Range Management 43(1): 64-68. (1990)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/431/16gutman.pdf>
 Descriptors: cows/ forage/ rotational grazing/ grazing/ dietary supplements/ liveweight gain/ Israel/ Mediterranean region
 This citation is from AGRICOLA.

993. How grazing and soil quality affect native and exotic plant diversity in Rocky Mountain grasslands.

Stohlgren, Thomas J.; Schell, Lisa D.; and Vanden Heuvel, Brian
Ecological Applications 9(1): 45-64. (1999)
 NAL Call #: QH540.E23; ISSN: 1051-0761
 Descriptors: multiscale vegetation sampling: sampling method/ competitive exclusion/ exotic species richness/ grazing enclosures/ intermediate disturbance/ mountain grasslands: habitat/ plant diversity/ soil quality/ species specific responses/ weed invasion
 Abstract: We used multiscale plots to sample vascular plant diversity and soil characteristics in and adjacent to 26 long-term grazing enclosure sites in Colorado, Wyoming, Montana, and South Dakota, USA. The enclosures were 7-60 yr old (31.2 ± 2.5 yr, mean ± 1 SE). Plots were also randomly placed in the broader landscape in open rangeland in the same vegetation type at each site to assess spatial variation in grazed landscapes. Consistent sampling in the nine National Parks, Wildlife Refuges, and other management units yielded data from 78 1000-m² plots and 780 1-m² subplots. We hypothesized that native species richness would be lower in the enclosures than in grazed sites, due to competitive exclusion in the absence of grazing. We also hypothesized that grazed sites would have higher native and exotic species richness compared to ungrazed areas, due to disturbance (i.e., the intermediate-disturbance hypothesis) and the conventional wisdom that grazing may accelerate weed invasion. Both hypotheses were soundly rejected. Although native species richness in 1-m² subplots was significantly higher (P < 0.05) in grazed sites, we found nearly identical native or exotic species richness in 1000-m² plots in enclosures (31.5 ± 2.5 native and 3.1 ± 0.5 exotic species), adjacent grazed plots (32.6 ± 2.8 native and 3.2 ± 0.6 exotic species), and randomly selected grazed plots (31.6 ± 2.9 native and 3.2 ± 0.6 exotic species). We found no significant differences in species diversity (Hill's diversity indices, N1 and N2), evenness (Hill's ratio of evenness, E5), cover of various life-forms (grasses, forbs, and shrubs), soil texture, or soil percentage of N and C between grazed and ungrazed sites at the 1000-m² plot scale. The species lists of the long-ungrazed and adjacent grazed plots overlapped just 57.9 ± 2.8%. This difference in species composition is commonly attributed solely to the difference in grazing regimes. However, the species lists between pairs of grazed plots (adjacent and distant 1000-m² plots) in the same vegetation type overlapped just 48.6 ± 3.6%, and the ungrazed plots and distant grazed plots overlapped 49.4 ± 3.6%. Differences in vegetation and soils between grazed and ungrazed sites were minimal in most cases, but soil characteristics and elevation were strongly correlated with native and exotic plant diversity in the study region. For the 78 1000-m² plots, 59.4% of the

variance in total species richness was explained by percentage of silt (coefficient = 0.647, $t = 5.107$, $P < 0.001$), elevation (coefficient = 0.012, $t = 5.084$, $P < 0.001$), and total foliar cover (coefficient = 0.110, $t = 2.104$, $P < 0.039$). Only 12.8% of the variance in exotic species cover ($\log_{10}(\text{cover})$) was explained by percentage of clay (coefficient = -0.011, $t = -2.878$, $P < 0.005$), native species richness (coefficient = -0.011, $t = -2.156$, $P < 0.034$), and $\log_{10}N$ (coefficient = 2.827, $t = 1.860$, $P < 0.067$). Native species cover and exotic species richness and frequency were also significantly positively correlated with percentage of soil N at the 1000-m² plot scale. Our research led to five broad generalizations about current levels of grazing in these Rocky Mountain grasslands: (1) grazing probably has little effect on native species richness at landscape scales; (2) grazing probably has little effect on the accelerated spread of most exotic plant species at landscape scales; (3) grazing affects local plant species and life-form composition and cover, but spatial variation is considerable; (4) soil characteristics, climate, and disturbances may have a greater effect on plant species diversity than do current levels of grazing; and (5) few plant species show consistent, directional responses to grazing or cessation of grazing.

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994. How livestock grazing affects vegetation structures and small mammal distribution in the semi-arid Karoo.

Eccard, J. A.; Walther, R. B.; and Milton, S. J. *Journal of Arid Environments* 46(2): 103-106. (2000)
 NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
 Descriptors: rodents/ mammals/ wildlife/ livestock relationships/ distribution/ grazing/ food supply/ species diversity

Abstract: In this study the authors investigated vegetation changes superimposed by grazing and their effect on small mammals in the Karoo (South Africa) on grazed farmland and an adjacent, ten-year livestock enclosure. Plains and drainage line habitats were compared by monitoring vegetation height and cover, and small mammal species composition and abundance along transects. Animals were captured by live trapping. Vegetation cover was low on the grazed compared to the ungrazed study site, but vegetation height did not differ. The number of small mammal individuals and the number of species captured was higher at the ungrazed study site. Two species of climbing rodents captured in the ungrazed drainage line were absent from the grazed drainage line. Numbers of small mammals captured on the plains were similar for grazed and ungrazed land, but grazed plains were dominated by a single species of gerbil.

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995. The impact of burning and grazing on heathland plants and invertebrates in County Antrim.

Mcferran, D. M.; Mcadam, J. H.; and Montgomery, W. I. *Biology and Environment* 95B(1): 1-17. (1995);
 ISSN: 0791-7945

Descriptors: biodiversity/ heathland management
Abstract: The impact of burning and grazing on plant, ground beetle and spider species was investigated experimentally in stands of varying ages (burnt in 1982 and 1988 and unburnt plots) on an area of heather moorland in County Antrim, north-east Ireland. Burning initiated complex

succession pathways which appear to have characteristic plant and invertebrate species associations. Removal of *Calluna* dominance initiated a period of high plant species diversity. Investigation of initial post-fire regeneration suggested that the frequency of occurrence of plant species changed over time and was affected by grazing. Grouping of species by the position of their renewal bud, i.e. their life-form, did not account for all observed interspecific variation. The dominant species after burning were *Eriophorum vaginatum*, *E. angustifolium* and *Vaccinium myrtillus*. Studies of vegetation canopy structure showed that, even with the exclusion of the main grazing herbivores, *Calluna* will not re-establish itself as the dominant species until several years after burning. The ground beetle *Nebria salina* was trapped more often on plots burnt in 1988 than on unburnt plots or those burnt in 1982. In comparison, *Pterostichus niger* and *Carabus granulatus* were trapped in greater numbers on plots burnt in 1982 than on unburnt plots and plots burnt in 1988. The large species *Carabus problematicus* and *Carabus glabratus* were trapped in greater numbers on unburnt plots. Similarly, more of the spiders *Ceratinella brevipes* and *Centromerita concinna* were trapped on the plots burnt in 1982. In comparison, *Lepthyphantes zimmermanni* and *Robertus lividus* were trapped more often on unburnt plots than on plots burnt in 1982 and 1988. Results are discussed with respect to the importance of the continuation of traditional heathland management practices.

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996. Impact of cattle on conservation land licensed for grazing in South Westland, New Zealand.

Timmins, Susan M. *New Zealand Journal of Ecology* 26(2): 107-120. (2002)
 NAL Call #: QH540.N43; ISSN: 0110-6465

Descriptors: cattle stock intensity/ conservation land licensed/ grazing/ regeneration/ species structure/ vegetation species composition
Abstract: Making use of existing fences as ready-made enclosures, this study aimed to assess the long-term effects of cattle grazing on forest margins. Results indicated: 1) that cattle browsing and trampling has an impact on vegetation species composition, structure and regeneration; 2) that the effects of a particular grazing regime may take many decades to dissipate; and 3) that the impacts of cattle change with stock intensity. Some plant species appeared to be highly palatable to cattle and only occurred on sites without cattle. Such species included pate (*Schefflera digitata*), broadleaf (*Griselinia littoralis*), pigeonwood (*Hedycarya arborea*), supplejack (*Ripogonum scandens*), mahoe (*Melicactus ramiflorus*), milk tree (*Streblus heterophyllus*), lancewood (*Pseudopanax crassifolius*) and hen and chickens fern (*Asplenium bulbiferum*). A small group of plants appeared to regenerate better under cattle than in their absence, particularly mountain horopito (*Pseudowintera colorata*) and prickly shield fern (*Polystichum vestitum*). A few species were encouraged by cattle at one site but suppressed by them at another: kahikatea (*Dacrydium dacrydioides*), wheki (*Dicksonia squarrosa*), *Coprosma rhamnoides* and *Blechnum fluviatile*. The impact of cattle on most other plant species was not discernible. The results of this study, while somewhat equivocal, indicate that future grazing licences in South

Westland should restrict stock to low numbers and be confined to already modified sites where damage to conservation values would be minimal.

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997. Impact of different sheep grazing intensities on salt marsh vegetation in northern Germany.

Kiehl, K.; Eischeid, I.; Gettner, S.; and Walter, J. *Journal of Vegetation Science* 7(1): 99-106. (1996)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: plant ecology/ ecological succession/ halophytes/ vegetation/ species diversity/ salt marshes/ sheep/ grazing intensity/ natural resource management/ guidelines/ range management/ Germany

This citation is from AGRICOLA.

998. Impact of grazing management on biodiversity of grasslands.

Tallowin, J. R. B.; Rook, A. J.; and Rutter, S. M. *Animal Science* 81(2): 193-198. (2005)

NAL Call #: SF1.A56; ISSN: 1357-7298

Descriptors: biodiversity/ biological indicators/ botanical composition/ fauna/ grassland management/ grasslands/ grazing/ lowland areas/ nature conservation/ plant succession/ species diversity/ species richness/ stand structure/ weeds

Abstract: This paper reviews recent work carried out by the Institute of Grassland and Environmental Research and collaborating organizations that addresses some of the impacts of grazing management on both species-rich and species-poor lowland neutral grassland. Results indicate that for species-rich grassland, lenient grazing pressure maintained botanical diversity and the abundance of positive indicator species of nature conservation value over a 5-year period and also enhanced faunal diversity and abundance reflecting improvements in spatial, architectural and temporal structure. However, there was no enhancement in positive indicator species and there was also an increase in pernicious weeds suggesting that grazing alone may not suffice to deliver all the biodiversity goals for these grasslands and that additional management interventions may be required. For species-poor grassland, results indicate that distinctive differences in structure can lead to differences in faunal diversity. There is also some tentative evidence that livestock breed may affect invertebrate species assemblages.

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999. Impact of grazing management on the carbon and nitrogen balance of a mixed-grass rangeland.

Schuman, G. E.; Reeder, J. D.; Manley, J. T.; Hart, R. H.; and Manley, W. A.

Ecological Applications 9(1): 65-71. (1999)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: aboveground phytomass/ forage resources/ grazing management/ livestock stocking rate/ mixed grass rangeland: habitat/ nutrient availability

Abstract: Rangeland grazing management strategies have been developed in an effort to sustain efficient use of forage resources by livestock. However, the effects of grazing on the redistribution and cycling of carbon (C) and nitrogen (N) within the plant-soil system are not well understood. We examined the plant-soil C and N balances of a mixed-grass rangeland under three livestock stocking rates using an area that had not been grazed by domestic

livestock for more than 40 years. We established nongrazed exclosures and pastures subjected to continuous season-long grazing at either a light stocking rate (20 steer-days/ha) or a heavy stocking rate (59 steer-days/ha, approx 50% utilization of annual production). Twelve years of grazing under these stocking rates did not change the total masses of C and N in the plant-soil (0-60 cm) system but did change the distribution of C and N among the system components, primarily via a significant increase in the masses of C and N in the root zone (0-30 cm) of the soil profile. The mass of soil C (0-60 cm) under heavy grazing was comparable to that of the light grazing treatment. Grazing at the heavy stocking rate resulted in a decrease in peak standing crop (PSC) of aboveground live phytomass, an increase in blue grama (*Bouteloua gracilis* (H.B.K.) Lag. Ex Steud.), and a decrease in western wheatgrass (*Pascopyrum smithii* (Rydb.) A. Love) compared to the light grazing treatment. The dominant species under light grazing was western wheatgrass, whereas in the nongrazed exclosures, forbs were dominant and appeared to have increased at the expense of western wheatgrass. The observed increase of soil C and N in the surface soil where roots dominate indicates a greater opportunity for nutrient availability and cycling, and hence enhanced grazing quality.

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1000. The impact of grazing on plant communities, plant populations and soil conditions on salt marshes.

Bakker, J. P.

Vegetatio 62(1/3): 391-398. (1985)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: plant density/ grazing/ mowing/ natural resource management/ soil analysis/ salt marshes/ Western European region

This citation is from AGRICOLA.

1001. Impact of grazing on plant species richness, plant biomass, plant attribute, and soil physical and hydrological properties of vertisol in East African highlands.

Taddese, G.; Mohamed Saleem, M. A.; Abyie, A.; and Wagnew, A.

Environmental Management 29(2): 279-289. (2002)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: livestock/ plants/ agriculture/ biomass/ soil/ hydrology/ species diversity/ environmental impact/ land management/ grazing/ environmental effects/ vegetation effects/ soil properties/ soil compaction/ hydraulic properties/ species richness/ grazing effects/ grassland hydrology/ Africa, East/ grazing/ Ethiopia

Abstract: Understanding the problems of grazing land in vertisol areas and seeking long-lasting solutions is the central point where mixed crop livestock is the second stay for the majority of the population. In order to understand this, the current study was conducted at two sites, one with 0-4% slope and the other with 4-8% slope at Ginchi watershed, 80 km west of Addis Ababa, Ethiopia. The specific objectives of the study were to quantify changes in plant species richness, biomass, plant cover, and soil physical and hydrological properties. The grazing regimes were: moderate grazing (regulated), heavy grazing (free grazing), and no grazing (closed to any grazing), which was considered the control treatment. The results showed that the biomass yield in nongrazed plots was higher than in the

grazed plots. However, the biomass yield in grazed plots improved over the years. Species richness and percentage of dominant species attributes were better in medium grazed plots than the other treatments. Soil compaction was higher in very heavily grazed plots than in nongrazed and medium-grazed plots. In contrast to that, the soil water content and infiltration rate were better in nongrazed plots than in grazed plots. Soil loss in grazed plots decreased with the increase of biomass yields and as the soil was more compacted by livestock trampling during the wet season. Finally since the medium stocking rate is better in species richness and plant attributes, and lies between nongrazed and heavily grazed plots in the rest of the measured parameters, it could be the appropriate stocking rate to practice by the smallholder farmer.

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1002. Impact of grazing on the vegetation of South Sinai, Egypt.

Moustafa, Abdel Raouf A.

In: Sustainable land use in deserts/ Breckle, Siegmund-W.; Veste, Maik; and Wucherer, Walter.

Berlin: Springer-Verlag, 2001; pp. 218-228.

Notes: ISBN 3540677623

NAL Call #: GB611 .S87 2001

Descriptors: ecotoxicology/ grazing intensity/ human activity/ overgrazing impact/ protectorates/ species richness/ vegetation/ wadis/ book chapter

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1003. The impact of livestock grazing on landscape biophysical attributes in privately and communally managed rangelands in Namaqualand.

Petersen, A.; Young, E. M.; Hoffman, M. T.; and Musil, C. F.

South African Journal of Botany 70(5): 777-783. (2004)

NAL Call #: QK1.S69; ISSN: 0254-6299

Descriptors: altitude/ cycling/ erosion/ grazing/ ground cover/ infiltration/ landscape ecology/ leaching/ livestock/ nitrogen content/ nutrient content/ rangelands/ runoff/ soil alkalinity/ soil chemical properties/ soil fertility/ soil physical properties/ soil salinity/ species richness

Abstract: This study's objectives were to compare the impact of livestock on vegetation characteristics (species richness and cover), landscape functional attributes (nutrient recycling, water infiltration/runoff, soil stability status) and other soil chemical and physical properties at different altitudes on privately and communally managed rangelands in the vicinities of Kougoedvlakte, Kuile and Paulskraal in Namaqualand in South Africa. The applicability of on temporary methodology for quantifying underlying mechanisms contributing to landscape changes was also evaluated. Statistically significant differences in soil stability status and litter cover only were observed between the differently managed rangelands, these differences independent of altitude and attributed to greater substrate disturbance by livestock. However, on both the privately and communally managed rangelands, soil nutrient and water infiltration status, rock cover, soil alkalinity, salinity and total N content were significantly greater at low than high and/or medium altitudes. These differences reflected increased livestock grazing intensity with reduced rock cover, concomitant increase in soil alkalinity with increased faecal pellet density and reduced soil salinity due to greater erosion and active leaching of

less organically rich soils at lower altitudes. It is concluded that contemporary methodology applied, which was originally developed for grassland ecosystems, was unsuitable for detecting changes in critical landscape functional attributes that drive vegetation change within the succulent karoo biome.

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1004. The impact of livestock grazing on the persistence of a perennial forb in a temperate Australian grassland.

Dorrough, Josh and Ash, Julian

Pacific Conservation Biology 9(4): 302-307. (2003);

ISSN: 1038-2097

Descriptors: grazing management/ herbivory

Abstract: The presence of perennial plant species in grazed habitats may be an imperfect predictor of their long-term ability to persist under grazing by livestock. This is particularly the case in landscapes where grazing by livestock is a relatively recent occurrence or where management practices are leading to intensification of grazing. This paper investigates the impacts of grazing on the native perennial inter-tussock forb *Leptorhynchus elongatus* (Asteraceae) in grasslands on the Monaro Tablelands of New South Wales. Although the species persists in grazed habitats, exclosures indicate that current grazing management can lead to severe depletion of seed, largely due to selective removal of flowers and seed heads by livestock. A population model suggests that under current grazing management, population growth rates may be negative. Removal of livestock during flowering and seed set may assist long-term persistence of this species in grazed habitats. Despite almost 200 years of livestock grazing on the Monaro Tablelands, recent intensification of grazing management could result in the future loss of some plant species in grazed habitats.

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1005. Impact of management practices on the tall grass prairie.

Parton, W. J. and Risser, P. G.

Oecologia (Berlin) 46(2): 223-234. (1980)

NAL Call #: QL750.O3; ISSN: 0029-8549

Descriptors: cow weight gain/ Oklahoma/ USA/ elm/ ecosystem level model/ nutrient uptake/ grazing intensity/ nitrogen/ phosphorus/ heat/ water/ transpiration/ spring burning/ biomass simulation

Abstract: The ELM ecosystem-level grassland model simulates the flow of water, heat, N and P through the ecosystem and the biomass dynamics of plants, consumers and the decomposers. This model was adapted to a tallgrass prairie site in northeastern Oklahoma, USA, the Osage Site of the U.S. International Biological Program Grassland Biome. Several range management manipulations were simulated by the model and the results compared to field data and literature information: altering the grazing intensity, grazing system, and grazing time period; adding N and P to the grassland; adding water during the growing season; and spring burning of the prairie. The model showed that cattle weight gain per head, aboveground and belowground plant production, transpiration water loss, standing dead biomass, and the net N balance decrease with increasing grazing intensity, while soil water content and bare soil water loss increase. A moderately stocked year-round cow-calf grazing system is

more beneficial to the grassland than a more highly stocked seasonal steer grazing system because the former increases the aboveground and belowground primary production and the plant nutrient uptake rates. Range manipulations, such as fire, which stimulate uniform grazing of a pasture, increase primary production, cattle weight gains, and nutrient uptake of plants and animals. Model results indicated that adding fertilizer was the best strategy for increasing cattle weight gains per head, while adding water would produce the greatest increase in primary production. Simulation of yearly and triennial spring burns suggests that these treatments increase primary production, plant nutrient uptake, and cattle weight gain per head. Burning increases the N losses from the systems; however, these losses are greater with annual burns. The model results also suggest the spatial grazing pattern of cattle must be considered to represent correctly the impact of grazing on the prairie. The model is used to describe the behavior of the tallgrass prairie ecosystem, evaluate alternative management strategies, and identify future scientific research and management studies.

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1006. Impact of protection and free grazing on sand dune vegetation in the Rajasthan Desert, India.

Kumar, M. and Bhandari, M. M.

Land Degradation & Rehabilitation 3(4): 215-227. (1992)

NAL Call #: S622.L26; ISSN: 0898-5812

Descriptors: vegetation/ grazing intensity/ overgrazing/ deserts/ plant density/ livestock feeding/ land productivity/ environmental protection/ drought/ soil erosion/ climatic factors/ environmental impact/ soil degradation/ India

This citation is from AGRICOLA.

1007. The impacts of grazing and rainfall variability on the dynamics of a Sahelian rangeland.

Hein, L.

Journal of Arid Environments 64(3): 488-504. (2006)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: biological production/ biomass production/ botanical composition/ drought/ environmental impact/ grasslands/ grazing/ grazing systems/ rain/ range management/ rangelands/ semiarid grasslands/ stocking rate/ use efficiency/ grazing effects/ net primary production

Abstract: The impacts of grazing pressure and rainfall variability on rangeland dynamics have been the topic of much debate. Understanding the combined impact of these two factors is crucial for the development of efficient management strategies for rangelands. In this paper, the impacts of grazing and rainfall variability on the dynamics of a Sahelian rangeland in Northern Senegal are examined. Specifically, the paper assesses their combined impact on species composition, above-ground phytomass production and rain-use efficiency (RUE), on the basis of a 10-year (1981-1990) grazing experiment conducted in the Widou-Thiengoly catchment in the Ferlo, Northern Senegal. The experiment included both a high (0.15-0.20 TLU ha⁻¹, corresponding to current grazing) and a medium (0.10 TLU ha⁻¹) grazing pressure. It is shown that species composition, above-ground phytomass production and RUE markedly differ for these two grazing regimes - and that the differences are most pronounced in years with low rainfall. In dry years, both above-ground phytomass production and RUE are significantly reduced in the plots subject to a high grazing pressure. Consequently, the impacts of high

grazing pressures on the productivity of the Ferlo are hardly noticed during years with normal or above normal rainfall, but the rangeland's productivity is strongly affected during a drought. The findings have important implications for the management of rangelands; they indicate that high grazing pressures may increase the vulnerability of rangeland ecosystems and local people to droughts.

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1008. Impacts of grazing intensity and grazing systems on vegetation composition and production.

Bartolome, J. W.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. 917-925

NAL Call #: SF85.3.D48

Descriptors: grazing intensity/ grazing/ pastures/ ecosystems

This citation is from AGRICOLA.

1009. Impacts of grazing intensity and specialized grazing systems on the use and value of rangeland: Summary and recommendations.

Dwyer, D. D.; Buckhouse, J. C.; and Huey, W. S.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. 867-884

NAL Call #: SF85.3.D48

Descriptors: grazing intensity/ grazing/ range management/ pastures/ rangelands

This citation is from AGRICOLA.

1010. Impacts of grazing intensity and specialized grazing systems on watershed characteristics and responses.

Blackburn, W. H.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. p. 927-983. ill.

NAL Call #: SF85.3.D48

Descriptors: ecosystems/ grazing intensity/ grazing/ watershed management/ watersheds/ Idaho/ United States

This citation is from AGRICOLA.

1011. Impacts of grazing on wetlands and riparian habitat.

Platts, W. S. and Raleigh, R. F.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. 1105-1117

NAL Call #: SF85.3.D48

Descriptors: wetlands/ range management/ wildlife management/ grazing/ riparian buffers

This citation is from AGRICOLA.

1012. Impacts of grazing on wetlands and riparian habitat: A review of our knowledge.

Skovlin, J. M.

In: Developing strategies for rangeland management: A report/ National Research Council. Committee on Developing Strategies for Rangeland Management.; Series: Westview special studies in agriculture science and policy. Boulder, Colo.: Westview Press, 1984; pp. 1001-1103
NAL Call #: SF85.3.D48

Descriptors: pastures/ wetlands/ grazing/ riparian buffers
This citation is from AGRICOLA.

1013. Impacts of livestock grazing on lowland heathland.

Lake, S.; Bullock, J. M.; and Hartley, S.

Peterborough, U.K.: English Nature; 422, 2001. 143 p.
English Nature Research Reports.

Notes: ISSN: 0967-876X

<http://www.english-nature.org.uk/pubs/publication/PDF/Enrr422.pdf>

Descriptors: lowlands/ grazing/ conservation practices/ stocking rate

Abstract: Discusses aspects of grazing and heathland management. Covers livestock behavior, species differences, stocking rates, and impacts on native flora and fauna.

1014. Impacts of mule deer and horse grazing on transplanted shrubs for revegetation.

Austin, D. D.; Urness, P. J.; and Durham, S. L.

Journal of Range Management 47(1): 8-11. (1994)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1994/471/2aust.pdf>

Descriptors: Artemisia tridentata/ Chrysothamnus nauseosus/ Odocoileus hemionus/ horses/ grazing/ spring/ winter/ land restoration/ Utah

Abstract: Revegetation success on foothill ranges in northern Utah using big sagebrush (*Artemisia tridentata* Nutt. spp. wyomingensis Beetle and Young) and rubber rabbitbrush (*Chrysothamnus nauseosus* Britt. spp. albicaulis H. and C.) was determined as influenced by winter mule deer browsing and spring horse grazing. Treatment areas of 0.1 ha with 3 replications included a protected control, use by deer only, use by horses only, use by deer and horses, and use by deer with horse grazing delayed for 3 years after seedling transplant. Results from the first 6 growing seasons following transplanting of seedlings showed grazing by horses only tripled the available, per-plant browse production of big sagebrush compared to protected plots, whereas browsing by deer only resulted in a 40% decrease in browse production. Seedling survival of big sagebrush differed between treatments during the first 3 growing seasons but was not affected by grazing after the third growing season. Rubber rabbitbrush was not affected by treatments.
This citation is from AGRICOLA.

1015. Impacts of non-selective grazing on cover, composition, and productivity of Nama-Karoo grassy shrubland.

Beukes, P. C. and Cowling, R. M.

African Journal of Range and Forage Science 17(1-3): 27-35. (2000)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: Nama Karoo grassy shrubland: composition, cover, productivity/ annual rainfall/ biomass turnover rate/ compensatory growth/ concentrated defoliation/ defoliation regime/ diversity/ dunging/ grassy semi arid shrubland/ grazing strategies/ high intensity grazing/ Karoo veld: moribund, productivity/ large stock unit grazing days/ litter/ non selective rotational grazing system/ paddocks/ perennial species composition/ plant composition temporal changes/ rangeland quality: restoration/ short duration grazing/ short term rainfall/ trampling/ urination/ vegetation change/ vegetation parameters

Abstract: The non-selective rotational grazing system has undergone a long and controversial development. The merits of this grazing system, where relatively large numbers of livestock are herded into numerous small paddocks for short timespans with long rests between grazings, have not been formally evaluated in a long-term monitoring experiment in the Karoo. In this study we used exclosures (controls) on a 7 000 ha farm in the Central Lower Karoo, camped into approximately 50-ha paddocks, to evaluate the impact of this grazing system on certain vegetation parameters. We report on the first four years of monitoring, after each of four replicate paddocks had received four treatments (one treatment=40-60 Large Stock Unit grazing days per hectare over a period of 2-16 days). Concentrated defoliation with concomitant trampling, dunging, and urinating did not influence the perennial species composition, and cover of this grassy, semi-arid shrubland. Changes over time in plant composition, and cover are explained by annual, and short-term (e.g. quarterly) rainfall rather than by grazing impacts. Ephemerals were not favoured by this grazing system, but litter was more abundant in the treatment than the control areas. The dominant grass, *Eragrostis lehmanniana*, and shrub, *Pentzia incana*, are resilient to this defoliation regime, and show signs of compensatory growth. As yet there is no evidence that non-selective grazing increases diversity, but the severe defoliation and trampling may enhance the biomass turnover rate, resulting in more vigorous, and productive plants in the grazed areas. Diversity is unlikely to change rapidly in response to grazing, largely because of the persistence of grazing-tolerant perennials. Concentrating mixed herds of livestock onto small areas with lengthy rests can be a useful tool for 'kick-starting' moribund karoo veld into greater productivity. Several of the impacts hold potential for restoring the rangeland quality of degraded areas, but this needs to be tested.

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1016. Impacts of rotational grazing on mixed prairie soils and vegetation.

Dormaar, J. F.; Adams, B. W.; and Willms, W. D.

Journal of Range Management 50(6): 647-651. (1997)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1997/506/647-651_dormaar.pdf

Descriptors: range management/ rotational grazing/ grazing intensity/ *Hesperostipa comata*/ *Bouteloua gracilis*/ *Elymus lanceolatus*/ biomass/ rain/ soil chemistry/ chemical composition/ botanical composition/ plant litter/ Alberta
Abstract: In this study the impact of a rotation grazing system on the soil and vegetation of a *Stipa*-*Bouteloua*-*Agropyron* community in the mixed prairie ecoregion was compared with the ungrazed treatment in exclosures. At a

low stocking rate, grazing had no effect on the vegetation but did alter soil quality. Grazing pressure was so light in the rotational grazing treatment that recovery of productivity, as measured by standing crop and litter, was not significantly different from the ungrazed treatment. Conversely, the species distribution was unchanged but was indicative of a lower seral state for this mixed prairie. The effect of grazing on this community was indirect, possibly by altering the microenvironment. The relationships observed among forage production, soil chemistry, and species composition raise questions on the importance of any one variable expressing range condition on the mixed prairie.

This citation is from AGRICOLA.

1017. Implications of grazing vs. no grazing on today's rangelands.

Laycock, W. A.

In: Ecological implications of livestock herbivory in the West/ Vavra, M.; Laycock, W. A.; and Pieper, R. D. Denver, CO: Society for Range Management, 1994; pp. 250-280.

Notes: ISBN: 1-884930-00-X; Proceedings of the 42nd annual meeting of the American Institute of Biological Sciences.

NAL Call #: SF85.35.A17E28

Descriptors: prairies/ scrublands/ steppes/ deserts/ annual grasslands/ vegetation/ overgrazing/ biodiversity/ grasslands/ rangelands/ range condition/ range management/ grazing/ reviews/ species diversity/ nature conservation/ United States/ Ecological implications of livestock herbivory in the west/ North America/ America/ Developed Countries/ OECD Countries

Abstract: Literature on methods used to study the effects of grazing; determination of range condition; comparisons of grazing vs. no grazing (tallgrass prairies, northern mixed grass and palouse prairie, shortgrass steppe, SW desert grasslands, sagebrush-grass vegetation, other shrub-dominated vegetation types in the Great Basin, annual grasslands, riparian and more mesic mountain communities); effects of grazing on biodiversity; new conceptual stable state models; and management implications is reviewed. It showed that many vegetation types on public land are in a stable state condition and would change little if livestock were removed; very heavy grazing on small areas decreased biodiversity but moderate grazing was often beneficial to biodiversity and grazing increased patchiness of vegetation which should increase diversity of both plants and animals at a landscape level.

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1018. Improvement in rangeland condition of the Flooding Pampa of Argentina through controlled grazing.

Deregibus, V. A.; Jacobo, E.; and Rodriguezq, A.

African Journal of Range and Forage Science 12(2): 92-96. (1995)

NAL Call #: SB197.J68; *ISSN:* 1022-0119

Descriptors: grassland/ grazing/ herds/ resource management/ stocking rate/ vegetation

Abstract: The Flooding Pampa grasslands situated in temperate Argentina were ungrazed historically, but now support primarily breeding herds of cattle. These extensive, flat, infertile grasslands experience seasonal floods. Although summer droughts are usual, grasses maintain

productivity during the entire year and produce almost 6 t ha⁻¹ a⁻¹. Continuous grazing has caused deterioration of these grasslands in terms of floristic composition and soil properties (salinisation). Stocking rate has been adversely affected. Controlled grazing systems have been applied with the objective of preventing deterioration. The main characteristics of this system are the concentration of animals in large herds, non-selective grazing of dormant vegetation during autumn and winter, and selective grazing during spring and summer. Rotational grazing ensures adequate rest for grazed plants and promotes tillering and establishment of cool season grasses. A system of controlled grazing has shown an improvement in floristic composition and in animal production, despite no increase in primary production. This system should allow for a sustainable utilization of these grasslands.

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1019. Increasing stock numbers on deteriorating rangeland.

Van Vegten, J. A.

In: Proceedings of the symposium on Botswana's first livestock development project and its future implications/ Hitchcock, Robert K.

Gaborne : Natl. Inst. of Development and Cultural Research, Univ. College of Botswana, 1982; pp. 98-107

NAL Call #: SF55.B54S96 1981

Descriptors: range management/ stocking rate/ pastures/ degradation/ grazing/ deterioration/ landscapes/ rangelands/ Botswana

This citation is from AGRICOLA.

1020. Influence of deferred grazing on vegetation dynamics and livestock productivity in an Andean pastoral system.

Buttolph, L. P. and Coppock, D. L.

Journal of Applied Ecology 41(4): 664-674. (2004)

NAL Call #: 410 J828; *ISSN:* 0021-8901

Descriptors: alpaca/ aymara/ Bolivian Altiplano/ llama/ non-equilibrium/ rural development/ species diversity

Abstract: 1. Management recommendations intended to reduce rangeland degradation and increase livestock productivity often assume equilibrium conditions wherein vegetation and herbivore dynamics are tightly coupled. Recent research in Africa, Asia and North America, however, suggests that the dynamics of some arid systems are driven more by precipitation, a non-equilibrium factor. We examined the applicability of equilibrium and non-equilibrium theory for key grazing resources within an Andean pastoral ecosystem. 2. Residents of Cosapa, Bolivia, recently fenced off portions of critical communal grazing areas called bofedal (wet meadow) and gramadal (dry meadow) as part of a livestock development project. Fenced enclosures were used to implement seasonally deferred grazing practices. We evaluated the effects of deferred grazing on peak standing crop (SC), above-ground net primary production (ANPP) and plant species composition and diversity over a 4-month growing season across 10 locations. Effects of enclosure access on the productivity of alpaca Llama pacos, llama L. glama and sheep Ovis aries were assessed through interviews with 32 herd owners. 3. One to three years of deferred grazing had no effect on SC or ANPP from bofedal or gramadal, but it did reduce plant species diversity for bofedal. Access to enclosures improved survival rates of young alpaca and

birth rates for sheep. Llamas were typically denied access to enclosures, which negatively affected their productivity. 4. Our results suggest that both non-equilibrium and equilibrium forces operate on bofedal. Stable and low rates of ANPP are largely shaped by the cold climate, a non-equilibrium factor. Changes in plant species composition and livestock productivity, however, support equilibrium theory. 5. Synthesis and applications. Ecological models of rangeland dynamics often play a critical role in determining the direction of range management and pastoral development. On bofedal, we found that vegetation and herbivore dynamics are coupled to a large extent, consistent with predictions that equilibrium behaviour can occur for critical, mesic subsystems nested within arid landscapes. Seasonal grazing deferral on bofedal can thus yield benefits to livestock productivity. However, these benefits must be weighed against negative social consequences that can occur when communal resources are privatized.

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1021. The influence of different grazing regimes on Phragmites and shrub vegetation in the well-drained zone of a eutrophic wetland.

Vulink, J. T.; Drost, H. J.; and Jans, L.

Applied Vegetation Science 3(1): 73-80. (2000)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: grazing/ vegetation/ range management/ Phragmites australis/ Cirsium arvense/ Urtica dioica/ Poa trivialis/ Sambucus nigra/ cattle/ horses/ conservation areas/ ecological succession/ species diversity/ colonizing ability/ stocking rate/ Netherlands

This citation is from AGRICOLA.

1022. Influence of grazing and soil conditions on secondary savanna vegetation in India.

Pandey, C. B. and Singh, J. S.

Journal of Vegetation Science 2(1): 95-102. (1991)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: succession/ plant community character/ mathematical model/ climate tropics

Abstract: Savanna vegetation and pertinent soil features were studied on 43 sites in a dry tropical forest region of India. Grazing intensity ranged from 0.68 to 0.98. Soil moisture was positively related to the proportion of fine soil particles (< 0.1 mm), and the latter decreased while the proportion of coarse particles (2.0-0.5 mm) increased with increasing grazing intensity. Canopy biomass ranged from 28 to 104 g/m² in grazed communities and from 230 to 337 g/m² in ungrazed communities and was positively related to vegetation cover which ranged between 30 - 72% in grazed and 68 - 91% in ungrazed communities. Vegetation cover was negatively related to grazing intensity. Species richness and diversity were highest at low grazing intensity. Using community coefficients and Detrended Correspondence Analysis, the grazed stands were clustered into six and the ungrazed ones into three communities. The grazed communities were recognized as degradation stages and the ungrazed ones as recovery stages. Only five grass species, in various combinations were able to dominate in one of the different stages. Evidently the harsh climatic conditions (high temperatures,

high variability in rainfall and a long dry period) in the region permit only a few species already adapted to these conditions to participate in the succession.

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1023. Influence of grazing on the cenopopulation composition of Azerbaijan's desertified steppes and their protection.

Atamov, V. V. and Ponomarenko, L. I.

Problems of Desert Development(3): 70-73. (1996)

NAL Call #: QK938.D4P73; ISSN: 0278-4750

Descriptors: range management/ overgrazing/ grazing intensity/ grassland management/ grasslands/ steppes/ grazing/ environmental degradation/ grazing systems/ rotational grazing/ plant genetic resources/ Diplachne serotina

Abstract: The effect of grazing on desertified steppes at Gobustan, near Bozdag, in the Caucasus was studied in 100-m² plots of Bothriochloa ischaemum, Festuca valesiaca and Stipa lessingiana steppes. All three grasses were viable under grazing but other plants in the steppe communities were more vulnerable and their proportion in the stand was reduced by grazing. Diplachne serotina increased under grazing. As grazing intensity increased from slight to moderate to strong, the number of shoots/m² decreased from 312 to 197 to 102. The proportion of young inedible plants increased and the number of large palatable plants decreased with increasing grazing intensity. Plant cover decreased from 70-90% with no grazing to 30-40% at the end of grazing. Management of grazing by rotation is recommended.

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1024. The influence of grazing pressure on rooting dynamics of Caucasian bluestem.

Svejcar, T. and Christiansen, S.

Journal of Range Management 40(3): 224-227. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/403/7svej.pdf>

Descriptors: Bothriochloa caucasica/ USA/ warm season/ grass reseeding/ farmland/ depleted range/ stocking/ seasonal changes/ leaf area index/ water status/ climatic condition

Abstract: Caucasian bluestem (*Bothriochloa caucasica* (Trin.) C.E. Hubb.) is a warm-season grass introduced from Eurasia that is currently used for reseeding farmland and depleted range in the Southern Great Plains. Although this species is thought to be grazing tolerant, little specific information is available concerning its response to grazing. Variable (put-and-take) stocking was used to maintain heavy (3 to 8 steers/ha) and light (2.5 to 4.5 steers/ha) grazing treatments during mid May to late September from 1983 to 1985. Seasonal changes in root mass and root length to a depth of 60 cm were measured the first 2 years, and end-of-season root length was measured the third year. Leaf areas index (LAI) was measured during the first 2 years. Peak root mass was 27 and 46% less in heavily relative to lightly grazed swards in 1983 and 1984, respectively. Total root length for heavily grazed swards was 33 and 45% less than lengths of lightly grazed swards in 1983 and 1984, respectively. Heavy grazing resulted in a relatively larger reduction in LAI than in either root mass or length, and thus the ratio of absorbing root surface to transpiring leaf surface was greater for heavily grazed than lightly grazed plants. This increased ratio may explain our

previous observation that heavy grazing resulted in an improved water status of leaf tissue. End-of-season total root length over the 3-year period (15 to 18 and 24 to 28 km/m² for heavily and lightly grazed swards, respectively) was remarkably consistent given the variable climatic conditions over the study period.

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1025. Influence of livestock grazing on C sequestration in semi-arid mixed-grass and short-grass rangelands.

Reeder, J. D. and Schuman, G. E.

Environmental Pollution 116(3): 457-463. (2002)

NAL Call #: TD172.E52; ISSN: 0013-9327

Descriptors: C storage/ carbon/ grasslands/ grazing/ Great Plains

Abstract: We evaluated the effects of livestock grazing on C content of the plant-soil system (to 60 cm) of two semi-arid grasslands: a mixed-grass prairie (grazed 12 years), and a short-grass steppe (grazed 56 years). Grazing treatments included season-long grazing at heavy and light stocking rates, and non-grazed exclosures. Significantly higher soil C (0-30cm) was measured in grazed pastures compared to non-grazed exclosures, although for the short-grass steppe higher soil C was observed with the heavy grazing treatment only. Excluding grazing caused an immobilization of C in excessive aboveground plant litter, and an increase in annual forbs and grasses which lack dense fibrous rooting systems conducive to soil organic matter formation and accumulation. Our data indicate that higher soil C with grazing was in part the result of more rapid annual shoot turnover, and redistribution of C within the plant-soil system as a result of changes in plant species composition. Copyright © 2001.

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1026. The influence of livestock grazing on weed establishment and spread.

Lacey, J. R.

Proceedings of the Montana Academy of Sciences 47: 131-146. (1987)

NAL Call #: 500 M762

Descriptors: weeds/ crop-weed competition/ weed control/ livestock/ range management/ seed dispersal/ grazing/ Montana

This citation is from AGRICOLA.

1027. Influence of period of deferment before stocking spring-burnt sourveld on sheep performance and veld productivity.

Barnes, D. L. and Dempsey, C. P.

Journal of the Grassland Society of Southern Africa 9(4): 149-157. (1992)

NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: grazing/ lamb growth/ land management/ live mass gain/ livestock production/ pasture productivity

Abstract: Spring-burnt sourveld was stocked with Merino lambs after three different periods of deferment from the time of start of growth in spring. During three seasons, average seasonal livemass gains on veld which was stocked shortly after the start of growth were some 80% higher than on veld stocked two to three weeks later. Using veld from which grazing was excluded by means of exclosure cages as a control, the residual effects of the deferred grazing treatments on yields of grasses classified as palatable, intermediate or unpalatable were estimated in

the next season. Deferring grazing in spring was of negligible value in preventing loss of vigour of the palatable grasses. The respective yields for the three classes were on average for three seasons, 57, 101 and 144% of those for the controls. The findings indicate the need for drastic revision of current recommendations with regard to the management of sourveld for sheep production.

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1028. Influence of rainfall and grazing on herbage dynamics in a seasonally dry tropical savanna.

Pandey, C. B. and Singh, J. S.

Vegetatio 102(2): 107-124. (1992)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: biomass/ diversity

Abstract: Species composition and herbage dynamics in relation to rainfall variability and cattle grazing were studied in permanently protected, grazed, and temporarily fenced treatments on three sites in a seasonally dry tropical savanna. Permanently protected sites, established between 1979 and 1984, were 55-79% similar with each other in species composition, and 14-25% similar with grazed sites during the period 1986-1988. Similarity among grazed sites was only 36-43%. Number of species was greater in the grazed treatment than in the permanently protected treatment. The percentages of annual grasses and non-leguminous forbs were greater in grazed savanna than in permanently protected savanna. Species diversity was higher in grazed savanna than in the corresponding permanently protected savanna. Within the two annual cycles studied, peak live shoot biomass was 614 g m⁻² in permanently protected savanna, 109 g m⁻² in grazed savanna, and 724 g m⁻² in temporarily fenced savanna. Live shoot biomass in temporarily fenced savanna was 18 to 44% greater than in permanently protected savanna. Peak canopy biomass ranged from 342 to 700 g m⁻² in permanently protected savanna. It was related with total rainy season rainfall, and was particularly sensitive to late rainy season rainfall. On the other hand, peak canopy biomass in grazed savanna ranged from 59 to 169 g m⁻² and was related to grazing intensity rather than either total rainy season rainfall or late rainy season rainfall. Coefficient of variation of green biomass in permanently protected savanna was related with rainfall variability indicating it to be a pulsed system which responds quickly to rainfall events. Biomass of woody species ranged from 2466 to 5298 g m⁻² in permanently protected savanna and from 744 to 1433 g m⁻² in the grazed savanna. Green foliage biomass was 3.7 to 6.4% of the woody biomass in permanently protected and 5.6 to 5.9% in grazed savanna, and supplements substantially the fodder resource during the dry periods of the year.

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1029. The influence of stocking rate, range condition and rainfall on residual herbage mass in the semi-arid savanna of Kwazulu/Natal.

Hatch, G. P. and Tainton, N. M.

African Journal of Range and Forage Science 12(2): 76-80. (1995)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: cattle livestock/ forage deficit/ grazing/ regression model

Abstract: Grazing trials at two sites in the semiarid savanna of KwaZulu-Natal were stocked with cattle at light (0.17 LSU ha⁻¹), intermediate (0.23 LSU ha⁻¹) and heavy (0.30 LSU ha⁻¹) stocking. Pasture disc meter data collected over 116 three-week periods were used to develop a step-wise multiple linear model to predict the amount of residual herbage at the end of the summer growing season and the period (days) over which forage supplementation would be required to maintain animal mass during the winter dormant season. Residual herbage mass at the end of summer was significantly related to cumulative summer grazing days, rainfall and range condition (indexed as the sum of the proportions of *Themeda triandra*, *Panicum maximum* and *P. coloratura*). The period of forage deficit during which herbage mass declined below a grazing cut-off of 1695 kg ha⁻¹ was significantly related to residual herbage mass at the end of summer.

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1030. Influences of grazing and exclosure on carbon sequestration in degraded sandy grassland, Inner Mongolia, north China.

Su, Yong Zhong; Zhao, Ha Lin; and Zhang, Tong Hui
New Zealand Journal of Agricultural Research 46(4): 321-328. (2003)

NAL Call #: 23 N4892; ISSN: 0028-8233

Descriptors: degraded sandy grassland/ desertification/ exclosure/ grazing/ protective practices/ soil degradation

Abstract: Livestock grazing is recognised as one of the main causes of vegetation and soil degradation/desertification in the semi-arid Horqin sandy steppe of northern China. In this paper, soil-plant system carbon (C) in a representative degraded sandy grassland in the Horqin sandy steppe (42degree58' N, 120degree42'E altitude c. 360 m a.s.l.) was measured. Three situations: long-term continuous grazing (CG), exclosure for 5 years (5EX), and exclosure for 10 years (10EX), were compared to assess the effect of grazing management on C sequestration. Ground cover increased from the CG (35%) to the 5EX (63%) and to the 10EX (81%), and accordingly soil organic C at 0-15 cm depth and total plant components C increased from the CG (492 and 98 g m⁻²) to the 5EX (524 and 134 g m⁻²) and to the 10EX (584 and 317 g m⁻²). The results suggested that continuous grazing in the erosion-prone sandy grassland is very detrimental to vegetation and soil. Under exclosure conditions, vegetation restoration and litter accumulation significantly increased plant-soil system C storage, and thus sequestration of atmospheric C. It was concluded that the degraded sandy grassland could contribute to significant C sequestration with the implementation of protective practices.

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1031. An integrated approach to studying the role of grazing livestock systems in the conservation of rangelands in a protected natural park (Sierra de Guara, Spain).

Bernues, A.; Riedel, J. L.; Asensio, M. A.; Blanco, M.; Sanz, A.; Revilla, R.; and Casasus, I.

Livestock Production Science 96(1): 75-85. (2005)

NAL Call #: SF1.L5; ISSN: 0301-6226

Descriptors: livestock farming: applied and field techniques/ management strategy/ grazing system/ rangeland conservation

Abstract: The 'Sierra de Guara' Natural Park (81,491 ha, Huesca, Spain) is a protected Mediterranean mountain area dominated by shrub and forest pastures. Traditional agriculture, mainly extensive grazing systems, has decreased in the last decades; concurrently, invasion of shrub vegetation, landscape changes and higher risk of forest fires have been observed. A study, which started in 2000, was carried out with two broad objectives: at the farm level, to analyse the farming systems and evaluate management strategies; at the regional level, to give useful information to conservation authorities for better decision-making. An integrated approach with different spatial scales and methods of analysis was used. First, a survey covering all farms that utilized the Park was carried out and livestock farming systems were characterized in terms of grazing management, technical and socio-economic factors. Second, six representative areas were selected to evaluate, depending on livestock utilization, grass and shrub vegetation dynamics (biomass, green/dead ratio). Third, vegetation and livestock data were analysed using a Geographic Information System to identify constraining factors and areas of intervention. Key imbalances were identified that can threaten the sustainability of the Park: low continuity of farming families; intensification of the management system; degradation of grazing resources; and concentration of grazing areas. A number of management recommendations are raised. (c) 2005 Elsevier B.V. All rights reserved.

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1032. Integrated management systems for improvement of rangeland.

Scifres, C. J. and O'Connor, T. M.
In: No-tillage and surface-tillage agriculture: The tillage revolution/ Sprague, Milton A. and Triplett, Glover B. New York: Wiley, 1986; pp. 227-259

NAL Call #: S604.N63

Descriptors: rangelands/ range management/ woody weeds/ brush control/ grazing/ sowing

This citation is from AGRICOLA.

1033. Integrating agricultural land-use and management for conservation of a native grassland flora in a variegated landscape.

Mcintyre, S.
Pacific Conservation Biology 1(3): 236-244. (1994);
ISSN: 1038-2097

Descriptors: farm planning/ grazing/ habitat variegation/ herbaceous community/ limited fertilization/ management intensity/ pastoral production/ pasture utilization/ soil disturbance/ vegetation preservation

Abstract: Management of variegated landscapes (in which the native vegetation still forms the matrix but has been modified in a variable way) requires strategies to maintain or enhance existing vegetation within the context of human land-uses such as agriculture. Using rangelands in the New England region of New South Wales as an example, spatial patterns of land-use and modification are described. Management principles for conservation of herbaceous communities in areas of pastoral production are suggested, based on the following assumptions: 1) low intensity pasture utilization and management (i.e., limited fertilization, soil disturbance and grazing) is conducive to the maintenance of species richness at a local and regional scale; 2) stratification of management intensity on farms is

compatible with viable grazing operations; 3) landscape context is important as effects of management may spread beyond the managed area; 4) spatial arrangement of land-uses could be optimized to maintain or increase diversity. Although our understanding of these issues is incomplete, there is general observational and theoretical support for them. Incorporation of principles derived from these assumptions in the farm planning process is a useful strategy for preserving grassland vegetation in landscapes where opportunities for reserve conservation are limited.
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1034. Is the removal of domestic stock sufficient to restore semi-arid conservation areas?

Page, Manda J. and Beeton, R. J. S.
Pacific Conservation Biology 6(3): 245-253. (2000);
ISSN: 1038-2097

Descriptors: conservation area restoration/ domestic stock removal/ grazing regimes/ semi arid conservation areas
Abstract: Increasingly, conservation areas are proclaimed in non-pristine environments that have biodiversity values and the issue of how to change the management regime to restore such landscapes arises. Before gazettal in 1992, Currawinya National Park (28degree52'S, 144degree30'E) in south-west Queensland's mulga lands was grazed by domestic stock for over 130 years. Following gazettal, the area was destocked and a monitoring programme initiated to determine the response by the vegetation. This paper describes the grass dynamics in three vegetation communities on Currawinya National Park with three different grazing regimes. Data are presented for an on-park site (native and feral herbivores present), an off-park site (domestic, native and feral herbivores were present), and an enclosure (no mammalian herbivores present). The results show that removal of domestic livestock alone is not sufficient to promote rapid recovery of grass populations, and suggest that conservation area managers must reduce native herbivore numbers as well if the desired outcome is a return to the supposed "natural" condition.
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1035. A landscape-scale model for optimal management of sheep grazing in the Magellanic steppe.

Cingolani, Ana M.; Anchorena, Juan; Stoffella, Susana L.; and Collantes, Marta B.
Applied Vegetation Science 5(2): 159-166. (2002)
NAL Call #: QK900 .A66; ISSN: 1402-2001
Descriptors: grazing management: applied and field techniques/ landscape scale modeling: mathematical and computer techniques/ magellanic steppe
Abstract: Effective management of rangelands requires the development of landscape-scale models for predicting spatial and temporal variability of forage. In the Magellanic tussock steppes, as in other cold-temperate regions, grazing capacity is dependent on the winter season. To develop a management tool for the region, we analysed links between winter forage availability, weather, stocking rate and vegetation structure. We studied four paddocks over five years with a range of stocking rates from 0 to 1.53 sheep.ha⁻¹. We sampled forb and non-tussock graminoid biomass, vegetation structure and faecal pellet abundance at the end of each summer. Daily temperature and rainfall data were also recorded. A regression model explained the amount of winter forage as a positive function of graminoid

cover, spring minimum temperature, annual precipitation and a negative function of dwarf shrub canopy, bare soil and stocking rate ($R^2 = 0.59$). Interactions of structural variables with precipitation and stocking rate were detected, indicating strong fluctuations of forage availability in lawn communities dominated by short graminoids. The most probable causes of this response would be higher utilisation and lack of canopy structure. Our results illustrate how maps of vegetation structure, obtainable from satellite images, with weather and stocking rate data could be used for predicting optimal stocking rates in large, heterogeneous sheep paddocks.
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1036. Landscape structure and management regime as indicators of calcareous grassland habitat condition and species diversity.

Mitchley, Jonathan. and Xofis, Panteleimon
Journal for Nature Conservation 13(2-3): 171-183. (2005);
ISSN: 1617-1381

Descriptors: management regime/ species diversity/ landscape structure/ grazing management/ calcareous grassland habitat/ spatial landscape
Abstract: This study investigates the importance of spatial landscape characteristics and habitat management on the condition of calcareous grassland in the North Down Natural Area, Kent UK. We used a digitised map of the study area containing shapefiles of all the habitats including 82 patches of calcareous grassland together with management information for each patch and data on the presence and abundance of a range of calcareous grassland indicator plant species. We defined habitat condition by presence of indicator species and used classification trees to generate models with rules for predicting habitat condition from the landscape spatial characteristics and management information. We also applied the same method to investigate the factors affecting presence or diversity of three ecological groups of positive indicator species and dominance of a negative indicator species. All the models except one showed good classification accuracy and high kappa statistic. Favourable habitat condition was predicted by presence of different types of grazing management, presence of woodland around patches of calcareous grassland and shape complexity. These results indicate that calcareous grassland in favourable condition is management-dependent but also located in less intensively managed landscapes. Unfavourable habitat condition was predicted by threat factors such as lack of management and high incidence of arable or improved grassland around patches of calcareous grassland, indicating nutrient enrichment and habitat degradation. Some of these factors also predicted high diversity of the different ecological species groups. The value of this method for predicting habitat condition and species diversity from baseline ecological data for conservation monitoring at the landscape level is emphasised. (c) 2005 Elsevier GmbH. All rights reserved.
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1037. Length and timing of grazing on postburn productivity of two bunchgrasses in an Idaho experimental range.

Bunting, Stephen C.; Robberecht, Ronald; and Defosse, Guillermo E.

International Journal of Wildland Fire 8(1): 15-20. (1998)

NAL Call #: SD420.5.I57; ISSN: 1049-8001

Descriptors: fire/ grazing: timing/ livestock management/ plant mortality/ postburn productivity

Abstract: Plant mortality and productivity in semiarid grasslands may be affected by the length of time grazing is excluded during the postfire regeneration period. The degree of grazing tolerance for the semiarid bunchgrass species, *Festuca idahoensis* and *Agropyron spicatum*, exposed to fire, and how the variation in grazing tolerance was affected by the length of time allowed for undisturbed plant regeneration after fire, were central questions addressed in this study. We examined the degree of plant mortality and productivity that resulted from the interaction of fire and grazing. Plants exposed to fire alone, i.e., without subsequent defoliation, exhibited low plant mortality, although culm production was reduced relative to unburned plants. An early-season-defoliation treatment after fire resulted in the plant mortality as high as 50% for *Festuca* and 70% for *Agropyron* bunchgrasses. Plant height and the number of vegetative and reproductive culms were also most affected by this defoliation treatment. These detrimental effects were lessened when defoliation was delayed by one growing season after the fire. Although our results suggest that one growing season seems to be enough for both species to recover after the fire, more studies will be necessary to confirm these trends, and induce changes in current grazing management policies.
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1038. Livestock exclusion and belowground ecosystem responses in riparian meadows of eastern Oregon.

Kauffman, J. B.; Thorpe, A. S.; and Brookshire, E. N. J.

Ecological Applications 14(6): 1671-1679. (2004)

NAL Call #: QH540.E23; ISSN: 1051-0761

Descriptors: riparian environments/ meadows/ water quality/ livestock/ environmental restoration/ habitat improvement/ aquatic plants/ nitrification/ environmental impact/ grazing/ riparian vegetation/ riparian zone/ river basin management/ restoration/ agriculture/ USA, Oregon

Abstract: Ecological restoration of riparian zones that have been degraded by decades of overgrazing by livestock is of paramount importance for the improvement of water quality and fish and wildlife habitats in the western United States. An increasingly common approach to the restoration of habitats of endangered salmon in the Columbia Basin of the Pacific Northwest (USA) is to exclude livestock from streamside communities. Yet, few studies have examined how ending livestock grazing changes ecosystem properties and belowground processes in herbaceous-dominated riparian plant communities (meadows). Along the Middle Fork John Day River, Oregon, we compared ecosystem properties of dry (grass and forb-dominated) and wet (sedge-dominated) meadow communities at three sites that had been managed for sustainable livestock production with three sites where livestock had been excluded for 9-18 years as a means of riparian and stream restoration. Profound differences in the belowground properties of grazed and exclosed communities were measured. In dry meadows, total belowground biomass

(TBGB consisting of roots and rhizomes) was similar to 50% greater in exclosures (1105 and 1652 g/m super(2) in the grazed and exclosed sites, respectively). In exclosed wet meadows, the TBGB was 62% greater than in the grazed sites (1761 and 2857 g/m super(2), respectively). Soil bulk density was significantly lower, and soil pore space was higher in exclosed sites of both meadow types. The mean infiltration rate in exclosed dry meadows was similar to 13-fold greater than in grazed dry meadows (142 vs. 11 cm/h), and in wet meadows the mean infiltration rate in exclosures was 233% greater than in grazed sites (24 vs. 80 cm/h). In exclosed wet meadows, the rate of net potential nitrification was 149-fold greater (0.747 vs. 0.005 mu g NO sub(3)-N times [g soil] super(-1) times d super(-1)), and the rate of net potential mineralization was 32-fold greater (0.886 vs. 0.027 mu g N times [g soil] super(-1) times d super(-1), respectively) when compared to grazed sites, though changes observed in dry meadows were not significant. Livestock removal was found to be an effective approach to ecological restoration, resulting in significant changes in soil, hydrological, and vegetation properties that, at landscape scales, would likely have great effects on stream channel structure, water quality, and the aquatic biota.

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1039. Livestock exclusion increases the spatial heterogeneity of vegetation in Colorado shortgrass steppe.

Adler, P. B. and Lauenroth, W. K.

Applied Vegetation Science 3(2): 213-222. (2000)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: disturbance/ grazing/ Moran's I/ plant competition/ spatial dependence

Abstract: Spatial heterogeneity, an important characteristic in semi-arid grassland vegetation, may be altered through grazing by large herbivores. We used Moran's I, a measure of autocorrelation, to test the effect of livestock grazing on the fine scale spatial heterogeneity of dominant plant species in the shortgrass steppe of northeastern Colorado. Autocorrelation in ungrazed plots was significantly higher than in grazed plots for the cover of the dominant species *Bouteloua gracilis*, litter cover and density of other bunchgrasses. No species had higher autocorrelation in grazed compared to ungrazed sites. *B. gracilis* cover was significantly autocorrelated in seven of eight 60-yr ungrazed exclosures, four of six 8-yr exclosures, and only three of eight grazed sites. Autocorrelograms showed that *B. gracilis* cover in ungrazed sites was frequently and positively spatially correlated at lag distances less than 5 m. *B. gracilis* cover was rarely autocorrelated at any sampled lag distance in grazed sites. The greater spatial heterogeneity in ungrazed sites appeared linked to patches characterized by uniformly low cover of *B. gracilis* and high cover of C3 grasses. This interpretation was supported by simple simulations that modified data from grazed sites by reducing the cover of *B. gracilis* in patches of ca. 8 m diameter and produced patterns quite similar to those observed in ungrazed sites. In the one exclosure where we intensively sampled soil texture, autocorrelation coefficients for sand content and *B. gracilis* cover were similar at lag distances up to 12 m. We suggest that the negative effect of sand content on *B. gracilis* generates spatial heterogeneity, but only in the absence of grazing. An

additional source of heterogeneity in ungrazed sites may be the negative interaction between livestock exclusion and *B. gracilis* recovery following patchy disturbance.

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1040. Livestock grazing and biodiversity conservation in Mediterranean environments: The Israeli experience.

Perevolotsky, A.

Options Mediterraneennes Serie A, Seminaires

Mediterraneens(67): 51-56. (2005)

NAL Call #: S19.O681; ISSN: 1016-121X

Descriptors: biodiversity/ botanical composition/ conversion/ genetic diversity/ grazing/ grazing systems/ landscape/ livestock/ range management/ reviews/ species richness/ grazing-management

Abstract: Livestock grazing has been considered for many years a source of ecological disturbance to natural ecosystems. Consequently, grazing has been excluded from protected areas such as nature reserves. However, livestock grazing is one of the few available tools for the management of dense woody vegetation stands such as those characterising the Mediterranean landscape.

Recently, a more active mode of management has been proposed for biodiversity conservation in Mediterranean environments and livestock grazing should become part of it. This paper reviews research findings from Israel, concerning the relationships between livestock grazing and ecological parameters - genetic diversity, species richness and composition, and landscape structure - relevant for the conservation of biodiversity. The conclusion is that in most cases, livestock grazing can help achieve the conservation goals. However, a clear definition of operative conservation goals is a prerequisite for a successful management that optimises the benefits provided by the grazing livestock.

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1041. Livestock grazing and weed invasions in the arid West.

Belsky, A. Joy and Gelbard, Jonathan L.

Bend, Ore.: Oregon Natural Desert Association, 2000. 31 p.

<http://www.onda.org/library/papers/WeedReport.pdf>

Descriptors: livestock/ weeds/ ecological invasion/ environmental impact

1042. Livestock grazing: Animal and plant biodiversity of shortgrass steppe and the relationship to ecosystem function.

Milchunas, D. G.; Lauenroth, W. K.; and Burke, I. C.

Oikos 83(1): 65-74. (1998)

NAL Call #: 410 OI4; ISSN: 0030-1299

Descriptors: behavior/ birds/ ecosystems/ grasslands species diversity/ habitat use/ mammals/ prairies/ trophic relationships/ wildlife/ habitat relationships/ wildlife/ livestock relationships/ North America/ United States/ Colorado: Northcentral

Abstract: The responses of plants, lagomorphs, rodents, birds, macroarthropods, microarthropods, and nematodes to long-term grazing on North American shortgrass prairies were studied. Diversity, abundance, dominance, and dissimilarity responses to long-term grazing were variable across classes of organisms. lgh.

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1043. Livestock grazing effects on Southwestern streams: A complex research problem.

Rinne, J. N.

In: Riparian ecosystems and their management:

Reconciling conflicting uses. (Held 16 Apr 1985-18 Apr 1985 at Tuscon, Ariz.) Johnson, R. Roy; Ziebell, Charles D.; Patton, David R.; Ffolliott, Peter F.; and Hamre, R. H. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, United States, Forest Service; pp. 295-299; 1985.

NAL Call #: aSD11.A42

Descriptors: livestock/ habitats/ fish/ grazing/ riparian buffers/ streams/ New Mexico

This citation is from AGRICOLA.

1044. Livestock grazing impacts on rangeland ecosystems.

Holechek, J.

Journal of Soil and Water Conservation 35(4):

162-164. (1980)

NAL Call #: 56.8 J822; ISSN: 0022-4561

Descriptors: grazing systems/ environmental impact/ rangelands/ grazing/ ecology/ reviews/ livestock farming/ range management/ arid regions

Abstract: The impacts of livestock grazing, both controlled and uncontrolled on the rangeland ecosystem of the USA are discussed. Research provides strong evidence that controlled grazing by domestic livestock is compatible with other resources provided by rangelands and may be a valuable tool to enhance these resources. Research needs for the practice of multiple use of public lands are examined.

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1045. Livestock grazing management and biodiversity conservation in Australian temperate grassy landscapes.

Dorrough, J.; Yen, A.; Turner, V.; Clark, S. G.;

Crosthwaite, J.; and Hirth, J. R.

Australian Journal of Agricultural Research 55(3):

279-295. (2004)

NAL Call #: 23 Au783; ISSN: 0004-9409

Descriptors: grazing management: applied and field techniques/ ecosystem function/ grazing strategy/ vegetation heterogeneity

Abstract: There is an increasing interest in the development of livestock grazing management strategies that achieve environmental sustainability and maintain or improve the long-term production capacity of commercial grazing systems. In temperate Australia, these strategies are generally focussed on reducing perennial pasture decline, soil loss, acidity, and salinity. An additional challenge facing land managers and researchers is developing grazing strategies that also maintain and enhance local and regional biodiversity. However, few studies have assessed the compatibility of management practices for maintaining long-term productivity and biodiversity conservation. We still have only a very basic understanding of the effects of different grazing strategies and pasture management on biodiversity and this is a major impediment to the development of appropriate and compatible best management practice. We argue that although there is an increasing desire to find management strategies that protect and enhance biodiversity without

hindering long-term agricultural production, in many cases this may not be possible. Current knowledge suggests that compatibility is most likely to be achieved using low-input systems in low productivity (fragile) landscapes, whereas in highly productive (robust) landscapes there is less opportunity for integration of productive land-use and biodiversity conservation. There is an urgent need for improved communication and collaboration between agronomic and ecological researchers and research agencies to ensure that future programs consider sustainability in terms of biodiversity as well as pasture and livestock productivity and soil and water health.

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1046. Livestock grazing, rest, and restoration in arid landscapes.

Curtin, C. G.

Conservation Biology 16(3): 840-842. (2002)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: grazing management/ range management/ ecological restoration/ arid lands/ Western United States

This citation is from AGRICOLA.

1047. Livestock impacts on riparian ecosystems and streamside management implications: A review.

Kauffman, J. B. and Krueger, W. C.

Journal of Range Management 37(5): 430-438. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/375/11kauf.pdf>

Descriptors: grazing/ streams/ water resources/ livestock production/ riparian buffers

This citation is from AGRICOLA.

1048. Livestock management in the riparian ecosystem.

Bryant, L. D.

In: Riparian ecosystems and their management:

Reconciling conflicting uses. (Held 16 Apr 1985-18 Apr 1985 at Tuscon, Ariz.) Johnson, R. Roy; Ziebell, Charles D.; Patton, David R.; Ffolliott, Peter F.; and Hamre, R. H. (eds.)

Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, United States, Forest Service; pp. 285-289; 1985.

NAL Call #: aSD11.A42

Descriptors: livestock/ grazing

This citation is from AGRICOLA.

1049. Livestock pressure and aspect effect on temperate mountain grassland plant species.

Mendarte, S.; Amezaga, I.; Albizu, I.; Ibarra, A.; and Onaindia, M.

In: Integrating efficient grassland farming and biodiversity: Proceedings of the 13th International Occasional Symposium of the European Grassland Federation. (Held 29 Aug 2005-31 Aug 2005 at Tartu, Estonia.); pp. 255-259; 2005.

NAL Call #: SB202.E85 E87 2005

Descriptors: aspect/ grasslands/ grazing/ mountain areas/ mountain grasslands/ nature conservation/ pastures/ plant communities/ plant pests/ species richness/ temperate grasslands/ vertebrate pests/ *Agrostis nebulosa*

Abstract: The aim of this work was to determine the influence of aspect (North, South and Southwest) and livestock pressure (sheep, cattle and horses) (in relation to animal movement: Hut, Extensive, and Nap zones and

Water points) on the grassland herbaceous communities in the mountain grasslands in the Basque Country (northern Spain). Three grasslands differing in aspect were selected, four zones in relation to livestock grazing pressure within them. At each zone 3 sites were selected and 10 random quadrants (0.5x0.5 m) were used to determine plant composition and cover. Forty plant species were present overall and the most common were *Agrostis capillaris*, *Festuca rubra* and *Trifolium repens* with more than 20% of total cover each. The cover of the observed species changed among grazing pressures showing clearly structural differences. *A. capillaris* and *T. repens* presence was favoured by grazing pressure. The most intense livestock pressure (water points) reduced significantly species richness (13.8±or-1.10), directly related to the dominance of some species tolerant to high grazing pressure, namely gramineae as *A. capillaris* and *F. rubra*. The lowest grazing pressure and the highest spatial heterogeneity zones (with slopes and apparent rocks), i.e. Nap zones, supported the highest species richness (23.2±or-1.30). The intermediate species richness was found at the intermediate grazing pressure site, i.e. extensive zones (17.9±or-1.10). Thus, grazing pressure creates a mosaic of vegetation structures that function in the landscape maintaining a high diverse area.

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1050. Long-term changes of salt marsh communities by cattle grazing.

Andresen, H.; Bakker, J. P.; Brongers, M.; Heydemann, B.; and Irmeler, U.

Vegetatio 89(2): 137-148. (1990)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: invertebrates/ vegetation/ sedimentation/ population density/ species diversity/ immigration/ succession/ food web/ dominance

Abstract: Over a period of 9 years a grazing experiment was carried out in the mainland salt marsh of the Leybucht (Niedersachsen) with three stocking rates, namely, 0.5 ha⁻¹, 1 ha⁻¹, and 2 cattle ha⁻¹. These were also compared with an abandoned area. The results are based on sampling of the invertebrates in 1980, 1981, 1982, and 1988, and of the vegetation in 1980 and 1988. The rate of sedimentation is highest in the *Puccinellia maritima*-zone and decreases with the increase of stocking rates. The *Elymus pycnanthus* vegetation type becomes dominant in the higher salt marsh in the abandoned site. The canopy height decreases with increasing stocking rate, whereas a gradient in the structure of the vegetation develops with the lowest stocking rate. The population densities, the species-richness and the community diversity of invertebrates increases after the cessation of grazing. The high rate of sedimentation in the abandoned site promotes the immigration of species from higher salt marsh levels and adjacent grasslands, and eventually halotophilous species and communities may disappear. On the other hand grazing reduces numerous species living both in or on upper parts of the vegetation or being sensitive to trampling by cattle. The community structure shows that the salt marsh ecosystem changed from a food web dominated by plant feeding animals to a food web dominated by animals foraging on detritus. The salt marsh management has to be

differentiated into both ungrazed and lightly grazed areas (each 50%) of an overall grazing in large areas with less than 0.5 cattle ha⁻¹.

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1051. Long-term effects of livestock grazing in western conifer forests.

Sharrow, S. H.

Proceedings Annual Forest Vegetation Management Conference 20: 7-11. (1999)

NAL Call #: QH541.5.F6F67.

Notes: ISSN: 1057-2147

Descriptors: coniferous forests/ Western United States

This citation is from AGRICOLA.

1052. Long-term grazing influences on Chihuahuan desert rangeland.

Holechek, Jerry L.; Tembo, Ackim; Daniel, Alipayou; Fusco, Michael J.; and Cardenas, Manuel

Southwestern Naturalist 39(4): 342-349. (1994)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: brush control/ forage productivity/ range recovery/ vegetation composition

Abstract: Vegetation composition and forage productivity were studied on two Chihuahuan desert ranges with different management histories. They involved the conservatively grazed New Mexico State University College Ranch, and adjoining intermediately grazed Bureau of Land Management (BLM) ranges north of Las Cruces in southcentral New Mexico. Conservative and intermediate grazing involved about 30 and 50% average use by livestock of the key forage species, respectively. A major focus of this study was the influence of stocking rate on recovery of native perennial grasses on rangeland with moderate amounts of honey mesquite (*Prosopis glandulosa* Torr.) (College Ranch) compared to areas heavily dominated by mesquite (BLM). In fall of 1982 total perennial grass standing crop averaged 182 kg/ha and 36 kg/ha on the long-term conservatively (CG) and intermediately grazed (IG) ranges, respectively. By the fall of 1990 perennial grass standing crop had increased to 349 kg/ha and 159 kg/ha on the CG and IG ranges, respectively. Mesa dropseed (*Sporobolus flexuosus* Thurb. Rybd.) and black grama (*Bouteloua eriopoda* Torr.), two important Chihuahuan Desert forage species, had greater standing crop on the CG than IG range throughout the 1982-1991 study period. Our data indicate that some mesquite-dominated ranges in the Chihuahuan Desert are responsive to both favorable rainfall and conservative stocking if residual perennial grasses remain, and that livestock grazing is sustainable under utilization levels that involve removal of one-third of the current year's growth of key forage species (black grama, dropseeds, threeawns). On course sandy soils with a high canopy cover of honey mesquite, brush control may be necessary to initiate range recovery.

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1053. Long-term grazing study in spring-fed wetlands reveals management tradeoffs.

Allen-Diaz, B.; Jackson, R. D.; Bartolome, J. W.; Tate, K. W.; and Oates, L. G.

California Agriculture 58(3): 144-148.

(July 2004-Sept. 2004)

NAL Call #: 100 C12Cag; ISSN: 0008-0845

Descriptors: grazing/ cattle/ springs (water)/ wetlands/ ecosystems/ California

This citation is from AGRICOLA.

1054. Long-term heavy-grazing effects on soil and vegetation in the Four Corners Region.

Orodho, A. B.; Trlica, M. J.; and Bonham, C. D.

Southwestern Naturalist 35(1): 9-14. (1990)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: *Oryzopsis hymenoides*/ grass cover/ productivity/ microhabitat moisture

Abstract: The effects of previous heavy grazing over an extended period (> 50 years) were assessed by measuring soil and vegetation characteristics in paired plots inside and outside of Chaco Culture National Historical Park in northwestern New Mexico. Soil compaction was greater in the grazed areas. Soil moisture was greatest on the hillside position where greater herbage production for Indian ricegrass (*Oryzopsis hymenoides*) was found. Long-term heavy grazing has resulted in a reduction of desirable shrub vegetation; however, grazing has had little effect on grass over, density, and production. Indian ricegrass, the dominant cool-season grass, was found in greater proportions on the hillsides and hilltops than in swales. It is likely that this grass was influenced by soil characteristics and past grazing preferences.

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1055. Long-term impacts of extensification of grassland management on biodiversity and productivity in upland areas: A review.

Marriott, C. A.; Fothergill, M.; Jeangros, B.; Scotton, M.; and Louault, F.

Agronomie 24(8): 447-462. (2004)

NAL Call #: SB7.A3; ISSN: 0249-5627

Descriptors: literature reviews/ grasslands/ range management/ biodiversity/ fertilizer application/ fertilizer rates/ sustainable agriculture/ extensive farming/ grazing/ mowing/ biomass/ botanical composition/ experimental design/ Europe

This citation is from AGRICOLA.

1056. Long-term impacts of livestock grazing on Chihuahuan Desert rangelands.

Navarro, J. M.; Galt, D.; Holechek, J.; McCormick, J.; and Molinar, F.

Journal of Range Management 55(4): 400-405. (2002)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: beef cattle/ grazing intensity/ plant communities/ botanical composition/ drought/ precipitation/ range management/ New Mexico

Abstract: Rangeland ecological condition was monitored over a 48 year period on 41 sites on Bureau of Land Management rangelands scattered across 6 counties in southwestern New Mexico. All sites were grazed by livestock during the study period. Sampling occurred in 1952, 1962, 1982, 1992, 1997, 1998, and 1999. A modified Parker 3 step method in conjunction with Dyksterhuis quantitative climax procedures were used to determine rangeland ecological condition. At the end of the 48 year study period (1952-1999), the average rangeland ecological condition score across study sites was the same ($P > 0.05$) as the beginning of the study (39% versus 41% remaining climax vegetation, respectively). Major changes ($P > 0.05$)

in rangeland condition occurred within the study period due to annual fluctuations in precipitation. Ecological condition scores increased in the 1980s and early 1990s due to above average precipitation. However, drought in the early to mid 1950's and again in the mid to late 1990's caused rangeland condition scores to decline. At the end of the study (1997-1999), 38% of the sites were in late seral ecological condition, compared to an average of 25% in the 1952 to 1982 period. The amount of rangeland in late seral ecological condition increased while the amount of rangeland in mid seral and early seral condition decreased in the 1990s compared to the 1952-1962 period. The average percent cover of black grama (*Bouteloua eriopoda* Torr.) and tobosa (*Hilaria mutica* Buckley), the primary forage grasses in the Chihuahuan Desert, were the same ($P > 0.05$) in 1952 and 1999. Over the 48 year study period, the average cover of shrubs including honey mesquite (*Prosopis glandulosa* Torr.) showed no change ($P > 0.05$). However major increases in honey mesquite basal cover occurred on 1 site and creosote-bush (*Larria tridentata* [Pursh] Nutt.) increased on another. Grazing intensity was evaluated during the last 3 years of study (1997, 1998, 1999). Overall grazing use of forage across sites and years averaged 34% or conservative. Our research shows controlled livestock grazing is sustainable on Chihuahuan Desert rangelands receiving from 26-35 cm annual precipitation.

This citation is from AGRICOLA.

1057. Long-term influences of livestock management and a non-native grass on grass dynamics in the desert grassland.

Angell, Deborah L. and McClaran, Mitchel P.
Journal of Arid Environments 49(3): 507-520. (2001)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963
Descriptors: desert grassland/ grass dynamics/ grazing intensity/ livestock management long term influences/ native species decline/ stocking density
Abstract: Density of 23 perennial grass species was measured in 25 permanent plots nine times between 1972-2000. Grass density was not related to the intensity of livestock grazing. Only one species expressed a difference between the summer rest and no summer rest with heavier stocking grazing treatments: bush muhly (*Muhlenbergia porteri* Scribn. ex Beal) density was less under the no summer rest with heavier stocking treatment. Beginning in 1975, the non-native Lehmann lovegrass (*Eragrostis lehmanniana* Nees) spread from distant seedings to one plot, and by 1991, it was the dominant species on most plots. The density of native species was not related to the length of time that the non-native lovegrass was present on a plot. In general, native species declined prior to the arrival and increase of the non-native lovegrass.

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1058. Long-term soil nitrogen and vegetation change on sandhill rangeland.

Berg, W. A.; Bradford, J. A.; and Sims, P. L.
Journal of Range Management 50(5): 482-486. (1997)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1997/505/482-486_berg.pdf
Descriptors: exclosures/ grazing/ litter/ little bluestem/ organic carbon/ sand bluestem/ soil sampling/ Southern Plains/ western ragweed

Abstract: The effect of livestock grazing on organic C and N in rangeland soils is not well defined. In this study on sandy rangeland in western Oklahoma, we sampled 8 pastures moderately grazed by cattle and 8 adjacent exclosures ungrazed by livestock for years. The sagebrush was largely controlled by herbicide in the study areas. The C and N concentrations in the surface 5 cm of soil, total herbage production, and total N uptake by vegetation were similar ($P > 0.05$) in grazed and nongrazed areas. Carbon and N concentrations in soils sampled to a constant mass to a depth of 5 cm or less were not ($P > 0.05$) different from concentrations determined on soil sampled to a constant depth of 5 cm. When calculated on a content basis, grazing increased ($P < 0.001$) the bulk density (1.35 g cm^{-3}) compared to nongrazed pastures (1.19 g cm^{-3}) and had a significant ($P < 0.01$) effect on C and N in the surface 5 cm of soil. Litter and total N in litter were greater ($P < 0.01$) on nongrazed areas. Little bluestem (*Schizachyrium scoparium* (Michx.) Nash) and sand bluestem (*Andropogon hallii* Hack.) produced more herbage and had greater frequency on nongrazed areas, whereas blue grama [*Bouteloua gracilis* (H.B.K.)Lag. ex Griffiths], sand dropseed [*Sporobolus cryptandrus* (Torr.)Gray], and western ragweed [*Ambrosia psilostachya* DC.] in eased in frequency on grazed areas. Thus, 50 years of moderate grazing by rattle had no measurable effect on C and N concentrations in the surface 5 cm of the sandy soil or on total N uptake by plants as compared with nongrazed areas; however, significant differences occurred in species composition which may alter mechanisms of C and N balance.
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1059. Long-term vegetation change in relation to cattle grazing in subalpine grassland and heathland on the Bogong High Plains: An analysis of vegetation records from 1945 to 1994.

Wahren, C. H. A.; Papst, W. A.; and Williams, R. J.
Australian Journal of Botany 42(6): 607-639. (1994)
NAL Call #: 450 Au72; ISSN: 0067-1924
Descriptors: resource management/ vegetation composition/ vegetative structure
Abstract: Changes in vegetation composition and structure are described for grassland and heathland communities on the Bogong High Plains, in the Victorian Alpine National Park. The data are based on long-term records collected from permanent reference plots over the period 1945 to 1994 from plots established in 1945, 1946 and 1979. In the Pretty Valley grassland plots, established in 1946, cattle grazing has prevented the large-scale regeneration of a number of tall, palatable forbs and short, palatable shrubs, while in the absence of grazing, the cover of these life forms increased substantially. The amount of bare ground and loose litter was significantly greater on the grazed compared with the ungrazed plot. Between 1979 and 1994, there was little or no identifiable trend in the cover of vegetation or bare ground at either the Pretty Valley grazed site, or two additional grazed grassland sites established nearby in 1979. The current condition of grazed grassland on the Bogong High Plains is interpreted as stable, yet degraded. Improvement in condition will occur in the absence of grazing. In the Rocky Valley open heathland plots, established in 1945, increases in shrub cover over the study period were due to growth of shrubs following the 1939 bushfires that burnt much of the Bogona High Plains. From 1945-1979 shorter-lived shrubs increased in cover;

since 1979, these shrubs have senesced, and are being replaced mainly by grasses. On the grazed plot longer lived, taller shrubs have continued to increase in cover and are not senescing. Between 1979 and 1989, total shrub cover declined on the ungrazed plot, but increased on the grazed plot. There was no evidence that grazing has reduced shrub cover, and therefore potential fire risk, in open heathland. These findings have significant management implications for the Alpine National Park and are consistent with those from other regions in the Australian alps.

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1060. Long-term vegetation changes in experimentally grazed and ungrazed back-barrier marshes in the Wadden Sea.

Bos, Daan; Bakker, Jan P.; De Vries, Yzaak; and Van Lieshout, Suzan

Applied Vegetation Science 5(1): 45-54. (2002)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: back barrier salt marshes/ foraging/ grazing/ inundation frequency/ long term vegetation changes/ species richness/ vegetation: changes, development, succession

Abstract: Vegetation succession in three back-barrier salt marshes in the Wadden Sea was studied using a data set comprising 25 years of vegetation development recorded at permanent quadrats. The effect of livestock grazing on succession was assessed by comparing quadrats where grazing was experimentally prevented or imposed. We studied changes at the species level as well as at the level of the plant community. Special attention is given to effects on plant species richness and community characteristics that are relevant for lagomorphs (hares and rabbits) and geese. Inundation frequency and grazing were most important in explaining the variation in species abundance data. The three marshes studied overlap in the occurrence of different plant communities and the observed patterns were consistent between them. Clear differences in frequency and abundance of plant species were observed related to grazing. Most plant species had a greater incidence in grazed treatments. Species richness increased with elevation, and was 1.5 to 2X higher in the grazed salt marsh. Grazing negatively influenced *Atriplex portulacoides* and *Elymus athericus*, whereas *Puccinellia maritima* and *Festuca rubra* showed a positive response. The communities dominated by *Elymus athericus*, *Artemisia maritima* and *Atriplex portulacoides* were restricted to the ungrazed marsh. Communities dominated by *Puccinellia maritima*, *Juncus gerardi* and *Festuca rubra* predominantly occurred at grazed sites. As small vertebrate herbivores prefer these plants and communities for foraging, livestock grazing thus facilitates for them.

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1061. Managed grazing and seedling shelters enhance oak regeneration on rangelands.

McCreary, D. D. and George, M. R.

California Agriculture 59(4): 217-220, 222. (2005)

NAL Call #: 100 C12Cag; ISSN: 0008-0845

Descriptors: Quercus/ grazing/ livestock/ silvopastoral systems/ forest regeneration/ grazing management/ California

This citation is from AGRICOLA.

1062. Management of grazing animals for environmental quality.

Etienne, M.

Options Mediterraneennes Serie A, Seminaires Mediterraneens(67): 225-235. (2005)

NAL Call #: S19.O681; ISSN: 1016-121X

Descriptors: biodiversity/ environmental management/ European Union/ forests/ grasslands/ grazing/ rangelands/ reviews/ stocking rate/ woodlands

Abstract: Since the last decade, increasing importance has been given in the European Union to environmental concerns and sustainable development. This trend has led to consider grazing management not only as a way to transform primary production into meat or milk, but also as a tool to move grassland, rangeland or woodland trajectories towards higher biodiversity and lower environmental hazards. To warrant forest multifunctionality special attention is given to flexible grazing management techniques adapted to the potential multiple uses and the ecological dynamics of the forest. To reduce the threat of fire, grazing management is focused on stimulating dry forage intake and shrub browsing, and is adapted to the structure and spatial organisation of fire prevention management plans. To enhance biodiversity grazing management has shifted towards more diversified stocking rates, by organising grazing calendars adapted to the life cycle of endangered species or to high seasonal grazing pressure on specific ecological targets.

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1063. Management of New Mexico's riparian areas.

Baker, Terrell T.

In: 46th Annual New Mexico Water Conference proceedings: Watershed management: restoration, utilization, and protection. (Held 5 Nov 2001-7 Nov 2001 at: New Mexico Water Resources Research Institute; 2001.

<http://wrrri.nmsu.edu/publish/watcon/proc46/baker.pdf>

Descriptors: riparian areas/ environmental impact/ grazing management/ best management practices

Abstract: Discusses the history of riparian areas in New Mexico and provides an overview of grazing practices and systems designed to minimize environmental impacts.

1064. Management strategies for sustainable beef cattle grazing on forested rangelands in the Pacific Northwest.

DelCurto, T.; Porath, M.; Parsons, C. T.; and Morrison, J. A.

Rangeland Ecology and Management 58(2): 119-127. (2005)

NAL Call #: SF85 .J67; ISSN: 1550-7424

Descriptors: distribution/ mixed-conifer rangelands/ riparian areas

Abstract: Livestock grazing practices on public and private rangelands throughout the western United States are subject to increasing scrutiny. Much criticism arises from the tendency for livestock to concentrate in riparian areas and to disproportionately use the vegetation to the degree that riparian function and vegetation are compromised. The purpose of this synthesis article is to evaluate grazing-management strategies that encourage beef cattle to use forage resources away from riparian areas and areas where topographical features limit grazing use. Specifically, this paper evaluates individual management strategies and attempts to quantify the changes in distribution patterns and vegetation use. An effective strategy uses water

development to encourage uniform distribution. Likewise, timing and duration of grazing have dramatic influences on cattle distribution in riparian and upland range areas. In general, early in the grazing season, when upland forage is green and growing, cattle tend to distribute more uniformly than later in the season, when upland vegetation is dormant and cattle disproportionately use riparian areas. In addition, early in the season, cattle grazing forested rangelands seem to prefer south-facing aspects with more open canopies when compared with late-season distribution patterns when concentration switches to northerly aspects, denser canopies, and more diverse diets. Other factors that appear to influence distribution include cow breed, age, and stage of production. In addition, recent research suggests that as cows age, distribution patterns change: Older cows have been reported to travel further from water than their younger contemporaries as long as adequate forage is available in the uplands. Additional research is needed on beef cattle selection, technological applications, efficient herding practices, supplementation strategies, and whole-range management systems that encourage the sustainable use of rangeland resources.
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1065. Managing for biodiversity conservation in native grasslands on farms.

Dorrough, J.; Turner, V.; Yen, A.; Clark, S.; Crosthwaite, J.; and Hirth, J.

Wool Technology and Sheep Breeding 50(4): 760-765. (2002)

NAL Call #: 304.8 W888; ISSN: 0043-7875

Descriptors: biodiversity/ grassland management/ grasslands/ grazing/ nature conservation/ sustainability/ Australia/ Victoria/ Australasia/ Oceania/ Developed Countries/ Commonwealth of Nations/ OECD Countries/ Australia

Abstract: Native temperate grassland and grassy woodlands have been subject to considerable modification by livestock grazing and clearance for exotic pastures and crops. In Victoria, very little high-quality grassy vegetation persists. Consequently, native grasslands and grassy woodlands are considered endangered ecological communities and therefore are a very high priority for nature conservation. Most of the highest-quality grassland remnants occur in small, isolated areas on public land. The long-term persistence and resilience of these scattered remnants is uncertain. Although typical remnants on private land are of low quality, their large size means that they have the potential to play an important role in the conservation of grassy ecosystems. One of the major challenges of the future is determining how to enhance the quality of these remnants on private land while ensuring productivity for farmers. This paper describes the initial results of a joint project between Agriculture Division and Parks, Flora and Fauna Division within Victoria's Department of Natural Resources and Environment, Australia. This project involves collaborative work between scientists, farmers, extension officers and policy makers to develop best management practices so that native grasslands on farms are grazed in a sustainable manner. A detailed review of grazing management strategies in native grasslands was undertaken. As well, market research was carried out to identify the attitudes of farmers and extension officers towards grazing in native grasslands. This work identified a lack of knowledge about appropriate grazing

management strategies as the major impediment to conserving grasslands within productive grazing enterprises. Four high-priority research areas were identified, as follows: (1) assessment of different grazing management regimes (e.g., timing, set stocking versus cell grazing) for biodiversity enhancement or loss; (2) determination of maximum productivity gains in grasslands (e.g., fertiliser rates, livestock density) beyond which there is biodiversity loss; (3) cost-effective broadscale re-establishment and enhancement of native grassland; and (4) identification of productivity benefits of conserving biodiversity in natural grassland ecosystems.
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1066. Managing grassland for production, the environment and the landscape: Challenges at the farm and the landscape level.

Gibon, A.

Livestock Production Science 96(1): 11-31. (Sept. 2005)
NAL Call #: SF1.L5; ISSN: 0301-6226

Descriptors: range management/ grasslands/ livestock production/ environmental impact/ species diversity/ environmental quality/ pollution control/ public policy/ landscapes/ farm management/ geographical distribution/ sustainable agriculture/ literature reviews/ Europe
This citation is from AGRICOLA.

1067. Managing ungulates to allow recovery of riparian vegetation.

Krueger, W. C.

In: Proceedings of a symposium on sustaining rangeland ecosystems. (Held 29 Aug 1994-31 Aug 1994 at Eastern Oregon State College, La Grande, Oregon.) Edge, W. D. and Olsen-Edge, S. L. (eds.); Vol. Special Report 953. Corvallis, Ore.: Oregon State University Extension Service; pp. 160-164; 1996.

NAL Call #: 100 Or3M no.953

Descriptors: riparian vegetation/ grassland management/ plant communities/ palatability/ regrowth/ hydrology/ livestock/ wild animals/ range management/ grasslands/ riparian grasslands/ grazing/ management/ sustainability
Abstract: The literature evaluating grazing of large ungulates (livestock or big game) and the sustainability of riparian ecosystems is considered to be largely based on case history and observations but clarifies the site specificity of management influences on riparian vegetation. It is suggested that grazing strategies based on a knowledge on animal behaviour, palatability, plant responses to grazing, plant community responses, hydrology and practicality may be integrated into society and ecological requirements for ecosystem management. A land issues forum coordinated resource management planning protocol taking 11 months to implement is presented.

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1068. Manipulative grazing of plant communities.

Vavra, M.

Nato Advanced Science Institutes Series: Series A: Life Sciences 108: 167-178. (1986)

NAL Call #: QH301.N32

Descriptors: cattle/ livestock/ feed intake/ grazing/ liveweight gain/ range management/ plant communities/ United States

This citation is from AGRICOLA.

1069. Measurement of above-ground plant biomass, forage availability and grazing impact by combining satellite image processing and field survey in a dry area of north-eastern Syria.

Hirata, M.; Koga, N.; Shinjo, H.; Fujita, H.; Gintzburger, G.; Ishida, J.; and Miyazaki, A.

Grass and Forage Science 60(1): 25-33. (2005)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: field survey: applied and field techniques/ satellite image processing: mathematical and computer techniques/ above ground plant biomass/ dry season/ forage availability/ grazing impact/ growing season/ livestock management/ soil erosion protection

Abstract: Field survey and satellite image processing methods were used to estimate the total available forage over an area of 95 034 ha in north-eastern Syria, and to assess grazing impact on the area. The above-ground plant biomass was measured by a quadrat method at three sites in each of eight vegetation classes. Available forage was measured by excluding woody parts of shrubs from the whole aerial plant parts. The total above-ground plant biomass and available forage were estimated by extrapolating the measured point data to the whole target area using classified vegetation data by satellite image processing. Grazing impact was assessed by calculating the differences between the total available forage at the end of growing season and the end of dry season. The values for the estimated total available forage (s.e. of mean) in the area were 55 628 000 (12 920 000) kg DM and 30 007 000 (2 437 000) kg DM at the end of growing season and dry season respectively. Although the area of the cereal fields covered only 0.315 of the area, about 0.69 and 0.82 of the available forage existed in the harvested cereal fields at the ends of growing season and dry season respectively. The integration of cereal fields and rangeland is a normal land use system for livestock management in the area. The higher cover of herbaceous vegetation types showed higher grazing impacts which reduced the total available forage at the end of the growing season by 0.817 (0.199) at the end of the dry season. Although these dense herbaceous vegetation types could possibly produce more available forage, they would incur more intensive grazing impact. On the contrary, lighter grazing impact would occur with a higher cover of shrub vegetation types. The importance of maintaining plant cover over the rangeland area to protect the land against soil erosion is stressed.

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1070. Measuring plant diversity in the tall threetip sagebrush steppe: Influence of previous grazing management practices.

Seefeldt, Steven S. and McCoy, Scott D.

Environmental Management 32(2): 234-245. (2003)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: vegetation measurement: applied and field techniques/ fall grazed areas/ grazing timing/ long term grazing study/ multiscale modified whittaker plots/ plant diversity/ postfire vegetation composition: previous grazing practice impacts/ previous grazing management practice influences/ pseudoreplication: potential effects/ spring grazed area/ tall threetip sagebrush bunchgrass plant community/ tall threetip sagebrush steppe/ ungrazed areas/ vegetation changes: grazing induced/ wildfire

Abstract: In July 2000, a 490-ha wildfire burned a portion of a long-term grazing study that had been established in

1924 at the US Sheep Experiment Station north of Dubois, Idaho, USA. Earlier vegetation measurements in this tall threetip sagebrush (*Artemisia tripartita* spp. *tripartita*) bunch-grass plant community documented significant changes in vegetation due to grazing and the timing of grazing by sheep. A study was initiated in May 2001 using 12 multiscale modified Whittaker plots to determine the consequences of previous grazing practices on postfire vegetation composition. Because there was only one wildfire and it did not burn all of the original plots, the treatments are not replicated in time or space. We reduce the potential effects of pseudoreplication by confining our discussion to the sample area only. There were a total of 84 species in the sampled areas with 69 in the spring-grazed area and 70 each in the fall- and ungrazed areas. Vegetation within plots was equally rich and even with similar numbers of abundant species. The spring-grazed plots, however, had half as much plant cover as the fall- and ungrazed plots and the spring-grazed plots had the largest proportion of plant cover composed of introduced (27%) and annual (34%) plants. The fall-grazed plots had the highest proportion of native perennial grasses (43%) and the lowest proportion of native annual forbs (1%). The ungrazed plots had the lowest proportion of introduced plants (4%) and the highest proportion of native perennial forbs (66%). The vegetation of spring-grazed plots is in a degraded condition for the environment and further degradation may continue, with or without continued grazing or some other disturbance. If ecosystem condition was based solely on plant diversity and only a count of species numbers was used to determine plant diversity, this research would have falsely concluded that grazing and timing of grazing did not impact the condition of the ecosystem.

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1071. Medium-term changes in grass composition and diversity of Highland Sourveld grassland in the southern Drakensberg in response to fire and grazing management.

Short, A. D.; O'Connor, T. G.; and Hurt, C. R.

African Journal of Range and Forage Science 20(1): 1-10. (2003)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: conservation status/ fire response/ grass composition/ grassland diversity/ grazing management/ medium term changes

Abstract: This study examined the compositional stability of Highland Sourveld in response to fire and grazing by wildlife (Coleford Nature Reserve) and by cattle on three properties over 20-25 years. A limited amount of compositional change took place except on a property stocked 1.5 times as heavily as the others, but no species were lost. In general, Decreaser species decreased and Increaser 2 species increased, although individual species of a group did not show a consistent pattern of change in abundance. Consistent heavy grazing favoured mtshiki species (*Sporobolus africanus*, *Eragrostis plana*), stoloniferous species (*Paspalum notatum*) and *Alloteropsis semialata*. The extent of compositional change was least at an intermediate (0.4 versus 0.1-0.75AU ha⁻¹) stocking density. Clovelly soils were prone to twice as much change as Hutton or Mispah soils. On lands abandoned for >50 years, the dominant *E. curvula* declined by two thirds and small amounts of characteristic Highland Sourveld species

established. Infrequent burning (every six years) resulted in twice as much compositional change as annual burning. Ordination techniques revealed three main groups of species, in terms of their amount and direction of change, identifiable with the Increaser-Decreaser classification. Important contradictions were, however, evident, such as a similar response for the Decreaser *Themeda triandra* and the Increaser 2 *Diheteropogon filifolius*, indicating review of this classification is warranted for the Highland Sourveld. Changes in composition reflected changes in grass diversity (evenness, species richness, Shannon-Weaver diversity). Heavy grazing increased evenness, hence Shannon-Weaver diversity, through reducing the mono-dominance of *T. triandra*. Grazing-induced changes in grassland composition may therefore reflect the conservation status of grasslands.

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1072. Microbial carbon nitrogen and phosphorus in dry tropical savanna effects of burning and grazing.

Singh, R. S.; Srivastava, S. C.; Raghubanshi, A. S.; Singh, J. S.; and Singh, S. P.

Journal of Applied Ecology 28(3): 869-878. (1991)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: soil/ microorganism/ residue/ decomposition/ plant/ nutrient cycling/ immobilization/ mineralization/ resource management/ microbial population ecology

Abstract: (1) The effects of burning and grazing of dry tropical Indian savanna on the level of available nutrient pools and microbial C, N, and P were assessed. (2) The maximum amounts of available nutrients and microbial biomass occurred in the dry period and minimum in the wet period. (3) Burning and grazing increased inorganic N by 54% and 15-49%, respectively and also increased bicarbonate-extractable inorganic P by 35% and 27-32%, respectively. (4) Mean annual microbial C varied from 361 to 466 $\mu\text{g g}^{-1}$, microbial N from 35 to 44 $\mu\text{g g}^{-1}$ and microbial P from 16 to 23 $\mu\text{g g}^{-1}$ dry soil. The mean annual microbial C, N and P were positively related to other. (5) Burning increased microbial C by 18%, microbial N by 26% and microbial P by 35%, and grazing increased microbial C by 15-18%, microbial N by 14-23% and microbial P by 19-29%.

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1073. Moderate and light cattle grazing effects on Chihuahuan desert rangelands.

Holechek, J.; Galt, D.; Joseph, J.; Navarro, J.; Kumalo, G.; Molinar, F.; and Thomas, M.

Journal of Range Management 56(2): 133-139. (2003)
NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: arid lands/ livestock/ range management/ stocking rate

Abstract: Vegetation changes were evaluated over a 13 year period (1988-2000) on moderately grazed and lightly grazed rangelands in the Chihuahuan Desert of south central New Mexico. During the study period, grazing use of primary forage species averaged 49 and 26% on moderately and lightly grazed rangelands, respectively. Autumn total grass and black grama (*Bouteloua eriopoda* Torr.) standing crop were consistently higher on the lightly than moderately grazed rangeland throughout the study. Total grass standing crop declined on the moderately grazed rangeland when the last 3 years of study were compared to the first 3 years (10 versus 124 kg ha⁻¹), but

showed no change on the lightly grazed rangeland (320 versus 357 kg ha⁻¹). Black grama, the primary perennial grass in the Chihuahuan Desert, increased in autumn standing crop on the lightly grazed rangeland, but decreased on the moderately grazed rangeland. Dropseed (*Sporobolus* spp.) autumn standing crop decreased on both rangelands during the study. However, this decrease was greater on the moderately grazed rangeland (97% decline) than on the lightly grazed rangeland (67% decline). Perennial grass survival following a 3-year period of below average precipitation was higher on the lightly grazed (51%) than the moderately grazed rangeland (11%). Severe grazing intensities on the moderately grazed rangeland during the dry period (1994-1996) appear to explain differences in grass survival between these 2 rangelands. Our study and several others show that light to conservative grazing intensities involving about 25-35% use of key forage species can promote improvement in rangeland ecological condition in the Chihuahuan Desert, even when accompanied by drought.

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1074. Mosses mediate grazer impacts on grass abundance in Arctic ecosystems.

Van Der Wal, R. and Brooker, R. W.

Functional Ecology 18(1): 77-86. (2004)

NAL Call #: QH540.F85; ISSN: 0269-8463

Descriptors: arctic ecosystems/ grazing impacts: indirect/ growth forms/ herbivory/ insulation/ moss layer depth/ nutrient enrichment/ permafrost soils/ plant responses/ positive feedback loops/ soil temperature/ species abundance/ trampling

Abstract: 1. Large herbivores have significant impacts on the structure and function of temperate and tropical ecosystems. Yet herbivore impacts on arctic systems, particularly the mechanisms by which they influence plant communities, are largely unknown. 2. High arctic vegetation, commonly overlying permafrost soils, is often moss-dominated with sparse vascular plant cover. We investigated the potential influence of large herbivores on arctic plant communities via their impact on the depth of the moss layer, leading to warmer soils and potentially benefiting vascular plants. 3. We found that grazer impacts on moss depth, and subsequently soil temperature, may influence vascular plant abundance and community composition because of the observed positive but growth-form-specific response of vascular plants to soil warming, promoting grasses in particular. 4. We propose that the positive association of grasses and large herbivores in arctic moss-dominated systems results from two simultaneously operating positive feedback loops. First, herbivore grazing and trampling reduces moss layer depth, increasing soil temperatures. Second, grasses benefit directly from grazers as a result of additional nutrients from faeces and urine. Additionally, the tolerance of grasses to grazing may enable grasses to expand despite the losses suffered from herbivory.

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1075. Native grassland management: A botanical study of two native grassland management options on a commercial cattle property.

McGufficke, B. R.

Rangeland Journal 25(1): 37-46. (2003)

NAL Call #: SF85.4.A8A97; ISSN: 1036-9872

Descriptors: range improvement/ superphosphate/ botanical composition/ endemic species/ introduced plants/ sown pastures/ grazing management/ range management/ New South Wales

This citation is from AGRICOLA.

1076. 'Nature's Method of Grazing': Non-selective grazing (NSG) as a means of veld reclamation in South Africa.

Hoffman, M. T.

South African Journal of Botany 69(1): 92-98. (2003)

NAL Call #: QK1.S69; ISSN: 0254-6299

Abstract: Acocks was concerned with the past, present and future state of South Africa's vegetation and in the 1960's, together with several farmers in the eastern Karoo, developed a grazing system which he thought would restore the vegetation to its former pristine condition. Acocks felt that the grazing systems advocated by the Department of Agriculture at the time were partly responsible for the degraded vegetation of the region as these systems encouraged livestock to graze selectively, thereby overgrazing the more palatable species in the vegetation. He felt that by forcing animals to graze all species non-selectively, the more palatable elements would be able to out-compete the less palatable species and dominate the vegetation as he believed they once did in pre-colonial times. Acocks found theoretical support for his argument which also relied on relatively long rest periods between grazing events and suggested that this non-selective grazing system simulated the way in which the pre-colonial ungulate herds utilised the vegetation. Although Acocks never conducted the key experiments needed to test his ideas, his approach was supported by several farmers in the eastern Karoo who conducted trials on their farms to test the principles of the method. The approach advocated by Acocks, however, was in direct contrast to that proposed by the Department of Agriculture who were concerned about the comparatively high stocking rates advocated under Acocks' Non-Selective Grazing (NSG) system. Their own experiment on NSG found that it reduced plant cover and increased erosion and they believed that it would lead to further widespread degradation if implemented. Although Acocks was employed by the Department of Agriculture as a Botanical Survey Officer he was not a Pasture Research Officer and it was this latter group of employees who had the responsibility of researching and advocating appropriate grazing systems for South Africa's rangelands. Acocks was, therefore, instructed not to promote NSG in his official capacity. Despite this, Acocks' writing in the last ten years of his life is infused with the ideas of NSG which continue to influence the development of range management systems to the present.

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1077. New perspectives on sustainable grazing management in arid zones of sub-Saharan Africa.

Oba, Gufu; Stenseth, Nils Chr; and Lusigi, Walter J.

Bioscience 50(1): 35-51. (2000)

NAL Call #: 500 Am322A; ISSN: 0006-3568

Descriptors: arid zone/ climate/ equilibrium ecosystem/ grazing/ herbivory/ non equilibrium ecosystem/ stochastic weather/ sustainable grazing management
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1078. Nonequilibrium dynamics of sedge meadows grazed by cattle in southern Wisconsin.

Middleton, Beth

Plant Ecology 161(1): 89-110. (2002)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: non metric multidimensional scaling: nms/ cattle grazing: exclusion/ equilibrium theory/ mean percentage cover: structural changes/ mean percentage height: structural changes/ sedge meadows: long term structural characteristics, nonequilibrium dynamics, recovery/ shrub carr/ succession
Abstract: Equilibrium theory predicts that after disturbance, ecosystems eventually regain the structural and functional properties characteristic of their predisturbance condition. This study tested this idea by examining the effects of cattle grazing and exclusion on the long-term structural characteristics of sedge meadows in southern Wisconsin. To compare structural changes in mean percentage cover and height, repeated measures analysis was conducted on two sedge meadows over a twenty year period from 1977 to 1997. One sedge meadow was recovering from cattle grazing (cattle excluded in 1973) and the other was a reference area (nearly undisturbed). Both of these study sites changed structurally from 1977 to 1997, supporting non-equilibrium theory. Additional observations were made in a heavily and lightly grazed sedge meadow that were surveyed in 1977. As based on the positions of subunits in an ordination graph produced using Non-Metric Multidimensional Scaling (NMS), the recovery sedge meadow became less structurally similar to the grazed and more similar to the reference site over the 20 year study. However, from the perspective of mean maximum height in another NMS analysis, the recovery sedge meadow became less similar to the reference site over time likely because by 1997, a shrub carr of *Cornus sericea* had developed in the recovery sedge meadow that had been dominated by graminoids and forbs in 1977 (mean maximum height: 1977 vs. 1997; 0 vs. 47 cm). Seedlings of *Cornus sericea* were invading the grazed sedge meadows and in the recovery sedge meadow (cattle excluded 4 years earlier) in 1977. A shrub carr did not develop in the reference sedge meadow. Changes in the reference site were relatively minor over this time interval; certain species either increased or decreased in dominance, e.g., *Carex stricta* increased in cover (1977 vs. 1997, 20 and 28 mean percentage (%) cover, respectively). A few short-term species of the recovery sedge meadow followed the tenets of equilibrium theory. These became less common or disappeared 4-9 years after cattle exclusion including *Aster lanceolatus*, *Calamagrostis canadensis*, *Poa compressa*, *Solidago altissima* and *Verbena hastata*. Some of these species were eaten and likely spread by the cattle. This study suggests that the progression of sedge meadow to shrub carr may not be an inevitable outcome of succession but instead can be a consequence of past cattle grazing

history. Also, because the recovery and the reference sedge both changed structurally over time, the tenets of non-equilibrium theory were supported by this study.

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1079. North Dakota grasslands net primary productivity and plant nitrogen dynamics as a function of grazing intensity.

Shariff, Ahmed R.; Biondini, Mario E.; and Grygiel, Carolyn E.

Prairie Naturalist 26(3): 229-240. (1994)

NAL Call #: QH540 .P7; ISSN: 0091-0376

Descriptors: biomass growth/ grazing animal/ litter biomass/ nitrogen uptake/ root productivity/ seasonal dynamics/ standing dead biomass

Abstract: A study was conducted for two years in south central North Dakota to evaluate the responses of (1) growing season and annual above-ground net primary productivity (ANPP) and growing season root productivity (GSRP), (2) growing season above-ground nitrogen (N) uptake, and (3) seasonal N dynamics in above-ground standing dead biomass and in litter. Three treatments were used: long term not grazed (NG), a moderate (MGT) and a high (HGT) grazing intensity treatments. The MGT and HGT treatments consisted of the removal of 45% and 77% of annual above-ground biomass growth. The MGT treatment resulted in higher ANPP, GSRP, and above-ground N uptake than either the NG or HGT. Standing dead biomass and litter were higher in the NG treatment but the MGT treatment had higher N concentration.

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1080. Nutrient changes in tussock grasslands, South Island, New Zealand.

Mcintosh, Peter

Ambio 26(3): 147-151. (1997)

NAL Call #: QH540.A52; ISSN: 0044-7447

Descriptors: burning/ calcium/ grazing/ magnesium/ nitrogen/ nutrient budget/ nutrient change/ nutrient cycling/ phosphorus/ potassium/ resource management/ soil organic matter/ South Island/ spatial biomass/ terrestrial ecology/ tussock grasslands/ vegetation

Abstract: The New Zealand Resource Management Act (1991) requires that resources should be managed in a way that maintains their potential to meet the reasonably foreseeable needs of future generations, and the 1994 'High Country Review' considered that high country tussock grasslands should be managed in a manner "that will maintain or improve soil organic matter and soil nutrient balance." Nutrient change in grazed, unfertilized tussock grasslands has been measured or estimated from biomass changes, nutrient cycling estimates, temporal soil trends, and spatial biomass and soil comparisons of differently managed areas. There has been a net decline of nutrients in biomass and soils under grazing, or grazing with burning. Maximum measured losses are N 27 kg ha⁻¹ yr⁻¹; P 5.5 kg ha⁻¹ yr⁻¹; K 19 kg ha⁻¹ yr⁻¹; Mg 1.4 kg ha⁻¹ yr⁻¹; and Ca 30 kg ha⁻¹ yr⁻¹. These measured losses are greater than can be accounted for by the direct effects of grazing. Although knowledge gaps mean that a complete nutrient budget cannot be constructed, there is no evidence that such losses are significantly mitigated by addition of nutrients by weathering or other natural processes. It is therefore concluded that continued grazing and burning of tussock grasslands without nutrient inputs is unsustainable,

and that to maintain or improve nutrient balance a new approach to soil and vegetation management will be required.

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1081. Observations on vegetation responses to improved grazing systems in Somalia.

Thurow, T. L. and Hussein, A. J.

Journal of Range Management 42(1): 16-19. (1989)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1989/421/4thur.pdf>

Descriptors: botanical composition/ grazing/ plant communities/ vegetation types/ Somalia

This citation is from AGRICOLA.

1082. On the dynamics of grazing systems in the semi-arid succulent Karoo: The relevance of equilibrium and non-equilibrium concepts to the sustainability of semi-arid pastoral systems.

Richardson, F. D.; Hahn, B. D.; and Hoffman, M. T.

Ecological Modelling 187(4): 491-512. (2005)

NAL Call #: QH541.15.M3E25; ISSN: 0304-3800

Descriptors: agropastoral systems/ farming systems/ grasslands/ grazing/ rain/ range management/ rangelands/ semiarid grasslands/ simulation models/ soil water content/ stocking density/ temperature/ temporal variation

Abstract: Two long-term mechanistic models of grazing systems in the semi-arid succulent Karoo have been used to study factors that influence vegetation changes, livestock productivity and sustainability of the ecosystem. In this region of low and highly variable rainfall, goats and sheep feed on vegetation comprising perennial shrubs and annuals. A previously published model of the Namaqualand system (the "standard" model) explicitly simulates three guilds of perennial shrubs, a guild of annuals, forage consumption, growth of goats and goat reproductive and survival rates. The model also simulates variable rainfall and predicts that, if no steps are taken to control the goat population, stock numbers will vary widely between years and the population of the different plant guilds will fluctuate. Plots of model output indicate that the system is driven by rainfall. Temporal changes in the relative abundance of each guild vary with different sequences of rainfall having similar long-term mean and variability. A single run of the model may display equilibrium, disequilibrium and threshold behaviour. Thus, the system exhibits complex dynamics. If animal numbers are held constant at the long-term average of variable stock or at the recommended stocking rate then the cover of palatable shrubs decreases and that of toxic plants increases substantially. A "simplified" model based on an aggregated forage variable and equilibrium dynamics is inadequate to describe the behaviour of this system.

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1083. Patch dynamics under rotational and continuous grazing management in large, heterogeneous paddocks.

Teague, W. R. and Dowhower, S. L.

Journal of Arid Environments 53(2): 211-229. (2003)

NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: continuous grazing: applied and field techniques/ rotational grazing: applied and field techniques/ patch dynamics: heterogeneous paddocks

Abstract: Overoptimistic stocking rates are the leading cause of rangeland degradation. The phenomenon of

patch-selective grazing means that the stocking rate on heavily used patches is much higher than that intended for the area as a whole. In addition, the differential use of preferred areas in the landscape results in uneven distribution of animal impact. Landscape heterogeneity increases as grazing unit size increases, resulting in heavier impact on preferred areas. Such phenomena compound over time and have a major long-term impact on the environment and primary and secondary production. This study investigates whether rotational grazing allows reduction of, and recovery from, degradation caused by patch-selective grazing in large (1800-2100 ha) paddocks by providing adequate rest between grazing events. From 1995 through 1998, herbaceous basal area and bare ground changes were measured on adjacent heavily and lightly grazed patches in rotationally and continuously grazed paddocks. Although weather was a dominating influence ($p < 0.0001$), the eight-pasture rotation system resulted in greater perennial herbaceous basal area ($p = 0.0987$) and lower proportions of bare ground on bottomland soils ($p = 0.03$) and clay-loam soils ($p = 0.052$) than the continuously grazed control. The increases in basal area with rotational grazing were primarily due to increases in perennial C4 mid- and shortgrasses. Grazing treatment did not influence species aerial biomass composition ($p > 0.1$). This study provides evidence that in large paddocks, rotational grazing allows recovery from and reduces degradation caused by patch overgrazing. Planned rotational grazing addresses the root cause of patch overgrazing and deterioration. It is, therefore, a key tool in managing for sustainable use and restoration of rangeland. © The Thomson Corporation

1084. Perennial grass response to 10-year cattle grazing in the Mendoza Plain, Mid-West Argentina.

Guevara, J. C.; Estevez, O. R.; Stasi, C. R.; and Gonnet, J. M.

Journal of Arid Environments 52(3): 339-348. (2002)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: basal area/ cattle selectivity groups/ grazing intensities/ grazing strategies/ perennial grasses/ plant density

Abstract: Basal area (cm^2m^{-2}) and density (plants m^{-2}) for total, undesirable, intermediate and preferred perennial grasses were monitored in 1990 and in 2000 in response to two grazing strategies (yearlong continuous and rotational) and four grazing intensities (ungrazed; light, moderate and heavy grazing). Grazing intensity had a significant effect on basal area of perennial grasses. Basal area and density for all the grass groups tended to be higher in 2000 than in 1990 for all grazing intensities but the grazed treatments did not show significant differences in basal area and density increases from 1990 to 2000 for all the mentioned grass groups. Several hypotheses could be advanced to explain the limited grass response to treatments. The stocking rates applied may have been too light to cause significant effects. Grasses appear to be resistant under the grazing intensities used and the annual drought occurring during 7 of the 9 last years of the study. Given the history of heavy grazing in this environment, it is possible that what has been observed is natural temporal variation in basal area and plant density. © 2002 Published by Elsevier Science Ltd.

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1085. The piosphere revisited: Plant species patterns close to waterpoints in small, fenced paddocks in chenopod shrublands of south Australia.

Heshmatti, G. A.; Facelli, J. M.; and Conran, J. G.

Journal of Arid Environments 51(4): 547-560. (2002)
NAL Call #: QH541.5.D4J6; ISSN: 0140-1963

Descriptors: Waite-Nicolson rangeland management method: management method/ multivariate analysis: mathematical method/ grazing history/ paddock age/ paddock size/ piosphere/ plant species patterns/ semi arid chenopod shrublands/ site features/ small fenced paddocks/ stocking rates/ vegetation cover/ waterpoints
Abstract: The Waite-Nicolson rangeland management method for semi-arid chenopod shrublands predicts that smaller paddocks with medium to moderate stocking rates help to preserve the native vegetation. Vegetation cover around waterpoints in three small paddocks (<2000 ha) from Middleback Station, South Australia was studied using multivariate analysis. Data from quadrats sampled along radiating transects were tested for correlations with a number of site features and grazing history factors. Two significant associations were detected: quadrats with an abundance of *Rhagodia parabolica* and less palatable species such as *Maireana pyramidata*, and *Atriplex stipitata* were correlated positively with proximity to water points, paddock age and stocking rate, and negatively with paddock size. In contrast, quadrats with species such as *Rhagodia ulicina* and the more palatable *M. sedifolia* were correlated with increasing distance from the water points and paddock size, but negatively with age and stocking rates. Transect direction was not correlated with either group. Twelve of the 20 species examined, including the important forage species *A. vesicaria*, also were not correlated with those paddock and grazing features included here. These results suggest that the distribution of some chenopod shrub species in fenced paddocks is still possibly affected by a combination of these factors in the long term by grazing at densities of 6 ha sheep-1 and that the method, although maintaining the fodder species, may not be preserving biodiversity at these grazing levels, although further study is needed.

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1086. Plant and sward response to patch grazing in the Highland Sourveld.

Lutge, B. U.; Hardy, M. B.; and Hatch, G. P.

African Journal of Range and Forage Science 13(3): 94-99. (1996)

NAL Call #: SB197.J68; ISSN: 1022-0119

Descriptors: environmental degradation/ grasslands/ rangelands/ grazing/ overgrazing/ burning/ selective grazing/ grazing systems/ mixed grazing

Abstract: The effects of patch grazing by cattle and sheep on the vigour of *Themeda triandra*, and of the sward, and sward species composition was determined at Kokstad Agricultural Research Station, Natal. The generally held idea that a full season's rest followed by an early spring burn would prevent preferential grazing of patch grazed areas which had developed in the seasons before the rest was also tested. The vigour of *T. triandra* was estimated from etiolated growth of marked tussocks while sward vigour was indexed by aboveground herbage production (AGHP). Etiolated growth of *T. triandra* and AGHP of the sward within patches were negatively affected by three seasons of grazing, but a full season's rest appeared

sufficient to restore both the etiolated growth of *T. triandra* and the AGHP of the sward to a level similar to that in the non-patches. A full season's rest followed by spring burning did not, however, prevent preferential grazing of grazed patches which had developed in the seasons prior to the rest. Species composition within patches differed significantly from the species composition of non-patches. It is concluded that patch grazing may therefore initiate the rangeland degradation process in Highland Sourveld and patch grazing may be the focus from which rangeland degradation proceeds.

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1087. Plant community responses to short duration grazing in tallgrass prairie.

Gillen, R. L.; McCollum, F. T.; Hodges, M. E.; Brummer, J. E.; and Tate, K. W.

Journal of Range Management 44(2): 124-128. (1991)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/442/6gill.pdf>

Descriptors: cattle/ prairies/ rotational grazing/ grazing intensity/ stocking rate/ plant communities/ botanical composition/ ecological succession/ grazing/ Oklahoma
Abstract: A key to management of short duration grazing systems is maintaining proper rest periods for individual pastures, but information on the necessary length of rest periods for tallgrass prairie is limited. Research hypotheses for this study were that tallgrass prairie plant communities would respond differently to grazing schedules incorporating rest periods of varying lengths and that this response would be dependent on stocking rate. Treatments consisted of 3 grazing schedules (2, 3, or 4 rotation cycles per 152 day grazing season) and 2 stocking rates (1.6 and 2.2 times the moderate continuous rate). Plant frequency, standing crop, species composition, and forage utilization were sampled from 1985 to 1989. Precipitation was above average in 4 of the 5 study years. Grazing schedule did not affect any vegetation parameter over time. Stocking rate did not affect plant frequency or species composition. Standing crop was reduced and forage utilization increased at the higher stocking rate but these effects were consistent over time. Frequency of western ragweed [*Ambrosia psilostachya* DC.] and the relative species composition of the forb component increased in all grazed pastures compared to ungrazed pastures. The overall lack of major treatment effects was attributed to favorable precipitation, spring burning, and the initial high-seral successional stage of the experimental pastures.

This citation is from AGRICOLA.

1088. Plant responses to livestock grazing frequency in an Australian temperate grassland.

Dorrough, J.; Ash, J.; and McIntyre, S.

Ecography 27(6): 798-810. (2004)

NAL Call #: QH540.H6; ISSN: 0906-7590

Abstract: Livestock grazing is often thought to enhance native plant species co-existence in remnant grasslands but may also favour exotic invaders. Recommendations for appropriate grazing strategies are needed, for which an understanding of the response of plant species is necessary. We explored the response of plant species and plant functional groups to grazing in temperate grassland of the Monaro Tablelands of south-east Australia by comparing species abundance in adjacent areas that differed in livestock grazing regime (minimal, infrequent and

frequent). We also examined whether species with similar responses to grazing share certain traits and consider whether these traits might provide a useful method of assessing grazing impact. At the scale measured (0.25 m²), an infrequent grazing regime maximised plant species co-existence in these grasslands due to widespread invasion by exotic plant species at infrequent grazing intensity. Many native species declined in abundance when grazing frequency increased from minimal to infrequent. Annuals invaded under infrequent grazing while perennials declined most strongly under high frequency grazing. Low levels of grazing apparently reduce cover and create sites suitable for seed recruitment whereas more frequent grazing reduces the persistence of perennials. While there was a tendency for native species to be more susceptible to grazing impact than exotics, plant traits, in particular longevity (perennial, annual) provided a better prediction of the response of plants to grazing. Although a few native plant species persisted at high grazing frequency, even infrequent livestock grazing may not be appropriate for the conservation of many native perennial grassland species. Targeted reductions in grazing frequency may be necessary to enable the long-term coexistence of grazing susceptible species.

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1089. Plant species diversity and grazing in the Scandinavian mountains: Patterns and processes at different spatial scales.

Austrheim, Gunnar and Eriksson, Ove

Ecography 24(6): 683-695. (2001)

NAL Call #: QH540.H6; ISSN: 0906-7590

Descriptors: alpine habitat/ colonization/ grazing/ management regime/ persistence/ spatial scale variation/ species diversity/ species richness/ sub alpine habitat
Abstract: There is a long tradition of grazing by semi-domestic reindeer and sheep in alpine and sub-alpine Scandinavian habitats, but present management regimes are questioned from a conservation point of view. In this review we discuss plant diversity patterns in the Scandinavian mountains in a global, regional and local perspective. The main objective was to identify processes that influence diversity at different spatial scales with a particular focus on grazing. In a global perspective the species pool of the Scandinavian mountains is limited, partly reflecting the general latitudinal decline of species but also historical and ecological factors operating after the latest glaciation. At the local scale, both productivity and disturbance are primary factors structuring diversity, but abiotic factors such as soil pH, snow distribution and temperature are also important. Although evidence is scarce, grazing favours local species richness in productive habitats, whereas species richness decreases with grazing when productivity is low. Regional patterns of plant diversity is set by, 1) the species pool, 2) the heterogeneity and fragmentation of communities, and 3) local diversity of each plant community. We suggest that local shifts in community composition depend both on the local grazing frequency and the return-time of the plant community after a grazing session. In addition, an increasing number of grazing-modified local patches homogenises the vegetation and is likely to reduce the regional plant diversity. The time scale of local shifts in community composition depends on plant colonisation and persistence. From a mechanistic point of view, diversity patterns at a regional scale also depend on

the regional dynamics of single species. Colonisation is usually a slow and irregular process in alpine environments, whereas the capacity for extended local persistence is generally high. Although the poor knowledge of plant regional dynamics restricts our understanding of how grazing influences plant diversity, we conclude that grazing is a key process for maintaining biodiversity in the Scandinavian mountains.

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1090. Plant species dynamics in the Southern Tall Grassveld under grazing resting and fire.

Morris, C. D.; Tainton, N. M.; and Hardy, M. B.

Journal of the Grassland Society of Southern Africa 9(2): 90-95. (1992)

NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: *Aristida junciformis*/ sward stability/ mowing/ Natal

Abstract: An analysis of temporal changes in botanical composition in a long-term grazing trial indicates that species dynamics in the Southern Tall Grassveld of Natal are determined by the specific combination of grazing, mowing and fire impacts. Species composition of a grazing systems trial was recorded at intervals during 16 years, and in the 14 years following the removal of herbivores, during which time the experimental area was burnt periodically. Site trajectories in ordination space facilitated the assessment of the nature, magnitude and rate of species composition change under various combinations of impacts. Under rotational grazing and mowing, botanical change was minimal, both during the grazing and the subsequent rest and fire phases of the trial. It is suggested that the interruption of continuous grazing at a high stocking rate by a seasonal rest (rotational resting) promoted the invasion of the sward by *Aristida junciformis*. This also occurred in the continuously-grazed treatment at a high stocking rate when stock were removed from the treatment and periodic burning was introduced. It appears that swards dominated by *A. junciformis* remain stable under a rest and burning regime.

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1091. Plant species richness and composition along livestock grazing intensity gradients in a Namaqualand (South Africa) protected area.

Hendricks, H. H.; Bond, W. J.; Midgley, J. J.; and Novellie, P. A.

Plant Ecology 176(1): 19-33. (2005)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: botanical composition/ conservation areas/ grazing/ habitats/ livestock/ national parks/ palatability/ rangelands/ species diversity/ species richness/ stand structure/ trampling

Abstract: The study described changes in floristic and vegetation structure in relation to livestock grazing intensity in a conservation area in the Succulent Karoo, South Africa. Grazing by goats and sheep is allowed in the Richtersveld National Park (a contractual National Park) which is also an area of high floristic richness and endemism. We used goat faecal pellet density, degree of trampling and percentage bare-ground at distances from the stock posts as surrogates for a gradient in grazing pressure. A stock post is the place where farmers keep, in most cases in an enclosure called a 'kraal', their animals at night and to which they return every evening after the day's herding.

Twenty-seven stock posts were located in the Richtersveld National Park; nine stock posts on flats, foot-slopes and mountain each. We measured plant species richness and diversity, and mean percentage cover of the various plant growth forms (including the number of species falling into each growth form category) in each of the five 10 m x 10 m plots (each 200 m apart) demarcated along a transect of one kilometre length from the centre of each stock post. The results showed that distance from the stock post does reflect grazing intensity use because densities in faecal pellets rapidly declined with increasing distances away from the stock post for all habitats studied. Faecal density was positively correlated with stocking density. Plant species richness and diversity was at a minimum near stock posts. Plants able to endure the effects of heavy grazing occurred near stock posts where declines in palatable plant species, assumingly sensitive to heavy grazing and trampling, were recorded. Grazing increased vegetation patchiness up to 800 m from the stock post for all the habitats. The degree to which this change in species composition occurred did not depend on stocking densities, suggesting that both grazing and landscape variability were responsible for vegetation changes in rangelands of that area of the Succulent Karoo biome.

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1092. A plant trait analysis of responses to grazing in a long-term experiment.

Bullock, James M.; Franklin, Joe; Stevenson, Mark J.; Silvertown, Jonathan; Coulson, Sarah J.; Gregory, Steve J.; and Tofts, Richard

Journal of Applied Ecology 38(2): 253-267. (2001)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: community response/ grazing/ grazing season/ life history traits/ long term experiment/ mesotrophic grassland/ species richness/ winter grazing

Abstract: 1. There are few long-term experimental studies of plant community responses to changes in grazing intensity. Here we report species' changes in a mesotrophic grassland after 12 years of a grazing experiment and relate these changes to species' life-history traits. 2. The experiment was set up in 1986 on an extensified species-poor grassland in lowland UK. Treatments comprised sheep grazing vs. no grazing in winter, grazing vs. no grazing in spring, and two grazing intensities in summer, in a 2 X 2 X 2 factorial design with two replicate blocks. 3. Point quadrat surveys in 1998 showed responses to grazing treatments by 17 of the 22 most common species. Species showed different responses, many of which were specific to a grazing season. Community changes were similar under spring and winter grazing, but the heavier summer grazing had different consequences. Species richness was increased by spring grazing, decreased by heavier summer grazing and unaffected by winter grazing. 4. More species responded to treatments in the 1998 survey compared with a survey in 1990. Furthermore, the whole experimental grassland had changed between the surveys, probably as a result of falling soil fertility. The two dominant grasses had declined drastically and most other species had increased in abundance. Five new species were found in 1998. 5. Intensive surveys of dicotyledonous species in 1998 showed five of the 12 most common species had responded to grazing treatments. In most cases dicotyledonous species had increased in abundance under heavier grazing in one or more season, and species

richness was increased by spring and winter grazing. Compared with a 1991 survey, the number of species responding to treatments had increased by 1998 and seven new species were found. 6. We tested whether species' responses to grazing were linked to life-history traits according to three hypotheses: that heavier grazing would disadvantage (i) species grazed preferentially, (ii) species less able to colonize gaps or (iii) more competitive species. Mechanisms differed among seasonal treatments. Responses to heavier summer grazing were linked strongly to gap colonization ability. Responses to spring and winter grazing were positively related to grazer selectivity, a surprising result that might be explained if selectivity was positively related to plant regrowth ability. 7. This study shows the need for long-term experimental analyses of community responses to grazing as vegetation responses may develop over a long time. The traits analysis suggests it may be possible to predict changes in species composition under grazing through an understanding of the mechanisms of plant responses. Grassland managers require such information in order to manipulate grazing regimes to achieve, for example, diversification or weed control.

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1093. The positive and negative conservation impacts of sheep grazing and other disturbances on the vascular plant species and vegetation of lowland subhumid Tasmania.

Kirkpatrick, J. B.; Gilfedder, Louise; Bridle, Kerry; and Zacharek, Andrew

Ecological Management and Restoration 6(1): 51-60. (2005)

NAL Call #: QH75.A1 E362; ISSN: 1442-7001

Descriptors: fertilization: applied and field techniques/ ploughing: applied and field techniques/ conservation/ grazing/ biological diversity/ disturbance tolerance

Abstract: An important conservation question for grazed areas of lowland subhumid Tasmania is 'what effects do different, practical disturbance regimes have on native vegetation?' An experiment designed to determine the single and interactive effects of fire and sheep grazing was established at four sites with distinct vegetation types. There were significant interactive effects of fire and sheep grazing on vegetation attributes at all sites. An analysis of published and new data indicated that there were several vascular plant species that appeared dependent on sheep grazing for their persistence in the present landscape, while there were others that were intolerant of this disturbance but required other types of disturbance, such as mowing. However, most native species appeared to survive in a wide variety of disturbance regimes short of ploughing and fertilization. The implications of these results are that a variety of disturbance regimes is necessary to maintain biological diversity in this environment, and that the naturalness of the regime is not necessarily relevant to its use for conservation.

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1094. Potential herblayer production and grazing effects in anthropogenic savanna-grasslands in the moist tropical forests of the Western Ghats of India.

Lele, Sharachandra and Hegde, Gurupada T.

Tropical Grasslands 31(6): 574-587. (1997)

NAL Call #: SB197.A1T7; ISSN: 0049-4763

Descriptors: anthropogenic savanna grasslands/ herb layer production/ moist tropical forest

Abstract: The moist tropical forests of the Western Ghats of India are pockmarked with savanna-grasslands created and managed by local agricultural communities. A sample of such savanna-grasslands with differing growing conditions was studied in terms of peak above-ground biomass, monthly growth, and cumulative production under different clipping treatments. The herblayer was found to be dominated by perennial C4 grasses, with *Eulalia trispicata*, *Arundinella metzii* and *Themeda triandra* being common to all sites. Peak biomass ranged between 3.3-5.9 t/ha at sites most favourable for grass production. Across these sites, peak biomass was found to be inversely related to the number of rainy days during the growing season, suggesting that growth may be light-limited. This hypothesis is supported by the observation that growth is most rapid immediately after the easing of the monsoon. Single clips early in the growing season had no negative or a slightly positive effect on production, but mid-season single clips or continuous frequent clipping reduced production by as much as 40%. The results suggest that, while indiscriminate grazing may certainly be deleterious, it is possible to obtain sustained high yields from forest lands managed for grass production without totally excluding grazing.

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1095. Potential impacts of fire and grazing in an endangered ecological community: Plant composition and shrub and eucalypt regeneration in Cumberland plain woodland.

Hill, Sarah J. and French, Kristine

Australian Journal of Botany 52(1): 23-29. (2004)

NAL Call #: 450 Au72; ISSN: 0067-1924

Descriptors: enclosure plot method: applied and field techniques/ Cumberland Plain woodland: endangered ecological community, eucalypt regeneration, shrub regeneration/ environmental factors: fire, grazing/ species richness

Abstract: Enclosure plots were used to determine the effect of fire and grazing on the structure of a grassy-woodland community. Eighteen months after fire and fence treatments were applied, the species richness, cover and composition of shrubs, trees, herbs and grasses were assessed and compared to pre-treatment censuses. Unburned plots had fewer shrub species and a lower abundance of shrubs, indicating the importance of fire in promoting regeneration of shrub species. Eucalypt species were more abundant and richer following the wildfire burn in summer, suggesting timing of fires is an important aspect in the establishment of the canopy species. Interactions between fire and grazing were found for the abundance of eucalypts (although weak) and resprouting eucalypts, suggesting a subtle interaction between fire and grazing shortly after fire. There was no effect of grazing and no interaction effect between fire and grazing on shrub species richness and abundance or tree species richness and seedling abundance. All plots showed a change in species composition despite treatment, and 46 species (32% of total richness) were recorded only in the final survey. The high rainfall during the 18-month study is likely to be an important factor in facilitating the establishment of species following all disturbances. This may have ameliorated the impact of grazing as abundant food was available

throughout the woodland. The interaction between fire and grazing may be more important in structuring these grassy communities during periods of lower rainfall.

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1096. The potential importance of grazing to the fluxes of carbon dioxide and methane in an Alpine wetland on the Qinghai-Tibetan Plateau.

Hirota, Mitsuru; Tang, Yanhong; Hu, Qiwu; Kato, Tomomichi; Hirata, Shigeki; Mo, Wenhong; Cao, Guangmin; and Mariko, Shigeru

Atmospheric Environment 39(29): 5255-5259. (2005)
NAL Call #: TD881.A822; ISSN: 1352-2310

Descriptors: alpine wetland/ global warming potential/ livestock grazing impact/ diffusive conductivity

Abstract: To assess the impact of livestock grazing on the emission of greenhouse gases from grazed wetlands, we examined biomass growth of plants, CO₂ and CH₄ fluxes under grazing and non-grazing conditions on the Qinghai-Tibetan Plateau wetland. After the grazing treatment for a period of about 3 months, net ecosystem CO₂ uptake and aboveground biomass were significantly smaller, but ecosystem CH₄ emissions were remarkably greater, under grazing conditions than under non-grazing conditions. Examination of the gas-transport system showed that the increased CH₄ emissions resulted from mainly the increase of conductance in the gas-transport system of the grazed plants. The sum of global warming potential, which was estimated from the measured CO₂ and CH₄ fluxes, was 5.6- to 11.3-fold higher under grazing conditions than under non-grazing conditions. The results suggest that livestock grazing may increase the global warming potential of the alpine wetlands. (c) 2005 Elsevier Ltd. All rights reserved.

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1097. Prescribed fire and cattle grazing influences on the vegetation and elk use of a rough fescue community.

Jourdonnais, C. S. Univ. of Montana, 1985.

Descriptors: *Cervus canadensis*/ habitat management/ livestock/ interspecific relations/ food supply/ Montana/ burning/ carbohydrates/ cattle/ chemical analysis/ communities/ elk/ fall/ fescue/ grasses/ grazing/ nutrients/ production/ soils/ spring/ standing crop/ utilization/ vegetation/ weather/ North America/ United States

Abstract: The influence of seasonal burning and fall cattle grazing were compared to the following: (1) production and composition of a rough fescue community; (2) elk use; (3) nutrient content of rough fescue, Idaho fescue (*F. idahoensis*) and bluebunch wheatgrass (*Agropyron spicatum*); (4) total nonstructural carbohydrate reserves of rough fescue and Idaho fescue; and (5) soil organic carbon content.

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1098. Prescribed grazing as a secondary impact in a western riparian floodplain.

Sedgwick, J. A. and Knopf, F. L.

Journal of Range Management 44(4): 369-373. (1991)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/444/13sedg.pdf>

Descriptors: floodplains/ autumn/ cattle/ biomass/ environmental impact/ plant ecology/ botanical composition/ community ecology/ *Salix*/ *Spartina*/ *Populus*/ leaves/ forage/ riparian buffers/ grazing/ *Spartina pectinata*

Populus deltoides subsp. *monilifera*/ Colorado

Abstract: The effect of late-autumn cattle grazing on plant biomass was examined in a western Great Plains cottonwood riparian zone prone to catastrophic flooding every 5-8 years. Following 1 year of pre-treatment data collection in 1982, five 16-ha pastures were grazed from 1982 to 1984 and compared to 5 control pastures within the South Platte River floodplain in northeastern Colorado. At a prescribed grazing level of 0.46 ha/AUM, riparian vegetation proved to be resilient to the impacts of grazing. We detected only a few significant treatment effects for above-ground biomass after succeeding growing seasons. Willows (*Salix* spp.) responded negatively to grazing whereas biomass of prairie cordgrass (*Spartina pectinata* Link) was greater on grazed plots. Yearly changes in above-ground biomass, especially dramatic following a severe flood in 1983, suggest that periodic, catastrophic flooding is a major perturbation to the ecosystem, and in conjunction with our results on grazing impacts, indicate that dormant-season grazing within Soil Conservation Service (SCS) guidelines is a comparatively minor impact within the floodplain. In addition, grazing impacts were probably further mitigated by a major forage supplement of cottonwood leaves which was available at the time of cattle introductions. This local forage supplement ultimately created a lighter grazing treatment than that originally prescribed.

This citation is from AGRICOLA.

1099. Prescribed sheep grazing to suppress cheatgrass: A review.

Mosley, J. C.

Sheep Research Journal 12(2): 74-81. (1996)

NAL Call #: SF371.R47; ISSN: 1057-1809

Descriptors: sheep/ grazing/ *Bromus tectorum*/ weed control/ range management/ fire ecology/ literature reviews
This citation is from AGRICOLA.

1100. The productivity of native grasslands oversown with legumes and grazed at five stocking rates in north-east Thailand.

Gutteridge, R. C.

Journal of Agricultural Science 104(pt. 1): 191-198. (1985)

NAL Call #: 10 J822; ISSN: 0021-8596

Descriptors: *Poaceae*/ *Arundinaria*/ *Stylosanthes*/ *Fabaceae*/ crop production/ range management/ grazing/ steers/ stocking rate/ grasslands/ Thailand
This citation is from AGRICOLA.

1101. Recovery in alpine heath and grassland following burning and grazing, Eastern Central Plateau, Tasmania, Australia.

Bridle, K. L.; Kirkpatrick, J. B.; Cullen, P.; and Shepherd, R. R.

Arctic Antarctic and Alpine Research 33(3): 348-356. (2001)

NAL Call #: GB395.A73; ISSN: 1523-0430

Descriptors: prescribed burning: management method/ alpine grasslands: habitat/ alpine heaths: habitat/ vegetation cover

Abstract: Long-term data from six sites in treeless subalpine and alpine vegetation in central Tasmania are used to document change in vegetation cover and life form dominance over time. All sites have been disturbed by burning and domestic stock grazing in the past. Although

burning ceased at least 8 yr before initial measurements were taken, stock grazing still occurs at one site, and rabbits and native vertebrate herbivores (mainly wallabies) graze throughout the region. Vegetation cover increased across all sites over a 5- to 23-yr period at an average annual increment of approximately 1%. There was no significant relationship between the initial cover of bare ground and change in bare ground over time for most of the sites. Annual increases in vegetation cover were least in locations grazed by rabbits and native vertebrate herbivores and where domestic stock still grazed. Exclosures grazed only by rabbits had an intermediate rate of increase. Vegetation cover was found to increase most in ungrazed exclosures. The rates of increase in vegetation cover suggest that, in the absence of fire, it is a matter of decades before cover will be almost complete in the area.
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1102. Recovery of a high elevation plant community after packhorse grazing.

Olson-Rutz, K. M.; Marlow, C. B.; Hansen, K.; Gagnon, L. C.; and Rossi, R. J.
Journal of Range Management 49(6): 541-545. (1996)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1996/496/541-545_olson.pdf
Descriptors: horses/ grazing intensity/ stand density/ plant communities/ environmental impact/ wilderness/ highlands/ Montana
Abstract: We evaluated the impact of packstock grazing on a dry, upper timberline meadow. Horses were picketed on 15 m ropes for different durations, months, and frequencies over 3 summers. Before horse grazing, we estimated vegetal, bare soil, litter, rock, and moss cover, measured grass and forbe plant heights, counted grass and forbe stems per area, and determined the percent of plants grazed. These measurements were repeated 1 growing season later. More bare ground and less litter and vegetal cover were recorded 1 year following single 8- or 18-hour grazing events. Single grazing events of 4-hour duration had no effect on cover. Decreases in vegetal cover were associated with reduced stem numbers. Eighteen hour picket durations reduced subsequent year production of grass and forbe stems. We discuss the difficulties encountered in this study, including estimates of necessary sample sizes, to help in the design of future studies.
This citation is from AGRICOLA.

1103. Recovery of streamside woody vegetation after exclusion of livestock grazing.

Rickard, W. H. and Cushing, C. E.
Journal of Range Management 35(3): 360-361. (1982)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1982/353/18rick.pdf>
Descriptors: Washington
This citation is from AGRICOLA.

1104. Recruitment and growth of Pacific willow and sandbar willow seedlings in response to season and intensity of cattle grazing.

Shaw, N. L. (Held 29 May 1991-31 May 1991 at Sun Valley, Idaho.) Clary, Warren P.; McArthur, E. Durant; Bedunah, Don; and Wambolt, Carl L. (eds.)

Ogden, Utah: US Department of Agriculture, Forest Service, Intermountain Research Station; pp. 130-135; 1992.
NAL Call #: aSD11.A48
Descriptors: Salix/ seedling growth/ grazing intensity/ cattle/ wildlife/ browsing/ plant density/ stems/ crown/ diameter/ spring/ autumn/ grazing/ riparian buffers/ Salix exigua/ Oregon
This citation is from AGRICOLA.

1105. Regeneration of degraded woodland remnants after relief from livestock grazing.

Pettit, N. E. and Froend, R. H.
Journal of the Royal Society of Western Australia 83(2): 65-74. (2000)
NAL Call #: 514 P432; ISSN: 0035-922X
Descriptors: degraded woodland: regeneration/ livestock grazing: disturbance factor
Abstract: Clearing for agriculture has left a mosaic of remnants of native vegetation in a matrix of agricultural land. Protection of these remnants is an important issue in minimising the effects of land degradation and for nature conservation in agricultural areas of Western Australia. The first approach to restoration is to remove the disturbing element, and in the case of livestock grazing this requires fencing to exclude stock and allow natural regeneration of the remaining vegetation. The description of this natural regeneration process is an essential first step in developing restoration techniques and management strategies for areas of degraded native vegetation. This article describes the changes in the vegetation for three different vegetation types in degraded woodland remnants in south-west Western Australia after livestock grazing has been excluded for seven years. These include vegetation types characterised by the overstorey species including jarrah (*Eucalyptus marginata*) marri (*Corymbia calophylla*), wandoo (*Eucalyptus wandoo*) and sheoak (*Allocasuarina fraseriana*). Species of the families Poaceae and Asteraceae were dominant in the understorey in grazed remnants for all vegetation types, with the majority of these species being exotics. After seven years, floristic similarity between fenced and grazed plots had decreased while similarity between fenced and ungrazed had increased, in all vegetation types. Native vegetation in jarrah sites have shown the greatest response to cessation of livestock grazing with an increase in species richness and diversity while wandoo and sheoak plots have showed little change. In terms of plant life forms, there was a significant increase in number and cover of native perennial grasses, perennial herbs and shrubs in the fenced jarrah plots. Response of annual species have tended to fluctuate with annual fluctuations in rainfall. There was variation in response to livestock grazing of different vegetation types within these woodland remnants. At a relatively early stage of decline in a remnant, the structure and composition of the native community can be reestablished by excluding stock. However, under severe and prolonged grazing, regeneration will be more difficult. These results indicate that the degree of difficulty of restoration will vary for different community types even within the broad category of jarrah and wandoo woodlands. Therefore, when managing for the restoration of remnants of native vegetation, consideration of vegetation type is an important factor.
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1106. Rehabilitation of degraded *Calluna vulgaris* (L.) hull-dominated wet heath by controlled sheep grazing.
Hulme, P. D.; Merrell, B. G.; Torvell, L.; Fisher, J. M.; Small, J. L.; and Pakeman, R. J.

Biological Conservation 107(3): 351-363. (2002)
NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: grazing management/ habitat degradation/ habitat rehabilitation/ habitat restoration/ stocking levels/ upland areas/ vegetation composition/ wet heaths: habitat
Abstract: Many upland areas of the British Isles have seen declines in the area and condition of heather (*Calluna vulgaris*)-dominated heathland vegetation. To reverse this decline, management regimes must be designed to rehabilitate areas that have seen this decline. As most of this heathland vegetation is primarily managed by grazing, such management has to determine what stocking levels can maintain the vegetation in a desired state. This paper describes how to reverse this decline through suitable grazing management. A degraded 'wet-heath' system, previously grazed at 2.1 sheep ha⁻¹, was subject to a range of grazing treatments over a 5-year period. Treatments varied in intensity (0-1.4 sheep ha⁻¹) and timing (summer only, winter only, or year round) of grazing. Grazing levels were maintained at 2.1 sheep ha⁻¹ outside the fenced areas. Vegetation composition remained stable outside the fenced treatments. All the fenced treatments showed an increase in the relative frequency of the evergreen *Calluna vulgaris*, with the greatest increase being in the ungrazed treatment, and the least in the year round 1.4 sheep ha⁻¹ treatment. This increase was in line with a reduction in heather utilisation to relatively low and sustainable levels. Other species that benefited from reduced grazing included *Carex nigra*, *Deschampsia flexuosa* and to a lesser extent *Galium saxatile* and *Erica tetralix*, whereas a range of moss species including *Hypnum jutlandicum* and *Rhytidiadelphus loreus* were more frequent at higher grazing levels. Though the recovery of heather was similar in the two seasonally grazed treatments, the vegetation showed different overall trajectories. Winter only grazed allowed a substantial increase in the cover of the deciduous *Molinia caerulea*, whereas this species was kept in check by summer only grazing. A stocking level of between 0.7 and 1.4 sheep ha⁻¹ appears to be appropriate to maintain and even enhance the cover of heather on degraded wet heath. Complete removal is not necessary. Grazing restricted to the winter period is inappropriate in areas where *M. caerulea* occurs. Setting appropriate stocking levels to maintain the condition of the vegetation must take into account site conditions, especially the presence of species that can affect the utilisation of heather.

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1107. Relationship among grazing management growing degree-days and morphological development for native grasses on the northern Great Plains.

Frank, A. B. and Hofmann, L.
Journal of Range Management 42(3): 199-202. (1989)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1989/423/6fran.pdf>

Descriptors: *Pascopyrum smithii*/ *Bouteloua gracilis*/ *Stipa comata*/ *Stipa viridula*/ *Koeleria pyramidata*/ regression analysis/ forage growth models

Abstract: Air temperature or growing degree-days (GDD) are known to influence morphological development of grass, but the effects of grazing history on grass

morphological development has not been established. Morphological development of 5 species located on moderately and heavily grazed mixed prairie sites near Mandan, North Dakota, was determined 3 times per week from beginning of growth in spring to heading. The species were western wheatgrass [*Pascopyrum smithii* Rydb.(Loeve)], blue grama [*Bouteloua gracilis* (H.B.K.) Lag. ex Griffiths], needleandthread (*Stipa comata* Trin. and Rupr.), green needlegrass (*S. viridula* Trin.), and prairie junegrass [*Koeleria pyramidata* (Lam.) Beauv.]. Regression analysis of growth stage with GDD was linear and statistically significant for prairie junegrass ($R^2 = 0.62$), green needlegrass ($R^2 = 0.96$), and needleandthread ($R^2 = 0.95$), and nonlinear for blue grama ($R^2 = 0.95$) and western wheatgrass ($R^2 = 0.97$). Prior grazing management had little effect on this relationship. The number of leaves and accumulated GDD required to produce those leaves varied by each species: prairie junegrass (4 leaves, 520 GDD), needleandthread (4 leaves, 640 GDD), green needlegrass (4 leaves, 800 GDD), blue grama (5 leaves, 1,300 GDD), and western wheatgrass (6 leaves, 1,450 GDD). Based on the species and conditions of this study, plant growth stage can be predicted from accumulated GDD and used for predicting grazing readiness and in development of forage growth models.
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1108. Relationships between biomass and plant species richness in arid-zone grazing lands.

Oba, Gufu; Vetaas, Ole R.; and Stenseth, Nils C.
Journal of Applied Ecology 38(4): 836-845. (2001)
NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: ordination analysis: statistical method/ pair wise test: statistical method/ arid zone grazing lands/ biomass/ floristic gradients/ herbivory/ hump backed models/ seasonal grazing exclosures/ species richness/ temperate vegetation

Abstract: 1. The relationship between biomass and species richness in temperate vegetation has been described as a hump-back response model. The hump-back model predicts that herbaceous species richness is highest at an intermediate level of biomass. However, this has not been investigated in arid-zone grazing lands. 2. We tested the hump-back prediction in an arid tropical grazing region in northern Kenya where a seasonal grazing exclosure system is practised. We compared vegetation structure, species richness and composition on an open range and exclosures at five sites to elucidate the potential mechanisms behind variation in species richness. 3. More biomass was accumulated within seasonal exclosures than in continuously grazed areas. Species richness in exclosure plots varied from 5.3 to 8.3 species m⁻², while that in open plots varied from 5.1 to 7.5 species m⁻². A pair-wise test showed no difference in two of the five sites with respect to both total and herbaceous species richness. 4. The primary floristic gradient illuminated through ordination was related to biomass, while the secondary gradient was related to species richness. The exclosure plots had more abundant species, especially compared with open plots, which had more rare and occasional species. A total of 37 herbaceous species was recorded; 22% were indifferent to grazing, 30% grazing intolerant and 48% promoted by grazing. 5. The relationship between biomass and herbaceous species richness showed (i) no trend within the exclosures (maximum biomass 800 g m⁻²); (ii) a positive trend in the

open grazing land (maximum of 500 g m⁻²); and a hump-back pattern when (i) and (ii) were analysed together. Optimum richness corresponded to a biomass level of 400-500 g m⁻². Species richness declined with increase in age of exclosures. 6. We confirmed that species richness will decline when biomass exceeds 500 g m⁻², as predicted by the hump-back model, even in arid grazing lands. Seasonal grazing exclosures may increase species richness to a certain level, but the decline in species richness with age of exclosures indicates that long-term exclusion of grazing may not necessarily increase species richness in arid-zone grazing lands.

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1109. Relationships between livestock management and the ecological condition of riparian habitats along an Australian floodplain river.

Jansen, Amy and Robertson, Alistar I.

Journal of Applied Ecology 38(1): 63-75. (2001)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: ecological conditions/ ecological restoration/ floodplain rivers/ grazing impact/ land use/ livestock management/ off river watering points/ paddocks/ private ownership/ riparian habitats/ stocking rates/ upstream distances

Abstract: 1. Grazing by introduced ungulate livestock is a major form of land use over large parts of Australia. Due to the tendency of stock to concentrate around water, riparian zones and wetlands are heavily impacted by grazing. However, little is known about how effects on riparian habitats vary spatially and with management regimes. We investigated how livestock affected riparian habitats on the Murrumbidgee River in south-eastern Australia. 2. A rapid appraisal index of the ecological condition of floodplain riparian habitats was developed. This measured habitat continuity and extent, vegetation cover, bank stability, soil structure, quantity of fallen debris, dominance of natives vs. exotics, and the presence of indicative species. The method could be readily adapted for use on other floodplain rivers with extensive riparian habitats. 3. Riparian condition was scored at 138 sites along 620 km of the Murrumbidgee River on private properties (n = 77), in State Forests (n = 27) and on Crown Land (n = 34). Riparian condition declined significantly with increasing grazing intensity and also with distance upstream in the upper half of the floodplain. 4. Stocking rate, distance upstream, relative periods of paddock rest and grazing, proportion of bank accessible to stock, and the presence of off-river water in the paddock, accounted for 76% of the variance in riparian condition. 5. Most riparian habitats on the Murrumbidgee River and other rivers in the Murray-Darling Basin are privately owned. Thus exclusion of the grazing industry from the riparian zone is not practical. However, lowered stocking rates, particularly in the upper parts of the catchment, resting of paddocks to allow recovery from grazing, and the provision of off-river watering points could all be used to improve riparian habitats. 6. Exotic plants are ubiquitous, occurring even where grazing has been excluded for many years. Thus restoration of riparian habitats will require weed removal even in areas not used by livestock.

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1110. The relative importance of cattle grazing in subtropical grasslands: Does it reduce or enhance plant biodiversity?

Mcintyre, S.; Heard, K. M.; and Martin, T. G.

Journal of Applied Ecology 40(3): 445-457. (2003)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: canonical correspondence analysis: cca, mathematical and computer techniques/ biodiversity conservation/ cattle grazing/ community composition/ eucalypt woodlands: habitat/ floristic variation/ land management/ lithology/ local extinctions/ regional conservation planning/ slope position/ soil disturbance/ species diversity/ species richness/ subtropical grasslands: habitat/ tussock structure/ water enrichment

Abstract: 1. Livestock grazing enterprises have potentially threatening effects on the conservation of plants in grassy subtropical eucalypt woodlands. Commercial levels of grazing could cause local extinctions of sensitive native species and/or reductions in abundance and species richness in native pastures. 2. We studied the nature of grazing impacts on the diversity and composition of herbaceous plants and used a natural experiment to analyse the effects of disturbances (cattle grazing, soil disturbance, water enrichment) and environment (lithology, slope position, presence of trees) on plant community composition in eastern Australia. We sampled pastures and reserves at 191 sites over an area of 3000 ha. 3. Canonical correspondence analysis (CCA) was used to explore the relative importance of disturbance and environment in accounting for floristic variation and to examine individual species responses. From individual responses, we identified seven response groups relating to grazing. The factors analysed explained small but significant amounts of floristic variation, and there were interactions between soil disturbance, water enrichment and grazing. 4. We explored the hypothesis that grazing increased species density at small scales but decreased it at landscape scales, due to the elimination of grazing-sensitive species. Our data did not support the hypothesis, as there were similar numbers of species that increase with grazing (increasers) and species that decline with increasing grazing (decreasers) in the assemblage. However, there were more native decreasers and more exotic increasers in the assemblage. 5. Synthesis and applications. For land managers to retain plant diversity on grazed landscapes, it would be desirable to provide all levels of grazing pressure across the landscape, including areas protected from livestock grazing. This would apply to all plant communities where both grazing increasers and decreasers are present. Extensive areas supporting grassland with a tall tussock structure that is selectively grazed are most important, as all plant response groups have some representation and ecosystem function is retained under moderate grazing. In terms of regional conservation planning, the protection and enlargement of areas protected from livestock grazing is important in the study area, as these occur on only about 4% of the landscape and are threatened by on-going disturbances and land-use intensification.

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1111. Resilience of South African communal grazing lands after the removal of high grazing pressure.

Harrison, Y. A. and Shackleton, C. M.
Land Degradation and Development 10(3): 225-239. (1999)
 NAL Call #: S622.L26; ISSN: 1085-3278
 Descriptors: communal grazing lands: grazing pressure, resilience

Abstract: A paired site study was conducted of communally grazed eutrophic and dystrophic grasslands and adjacent ungrazed areas of varying periods of exclusion from communal grazing. This allowed determination of the rate and extent of change of a number of vegetation and soil variables following the removal of high and continuous grazing pressure characteristic of communal lands. Similarity indices for grass species composition between the grazed and adjacent ungrazed areas showed a significant exponential decrease with increasing time since protection from continuous grazing. Most change in grass species composition occurred within four to nine years of protection from communal grazing in eutrophic grasslands, and in six to nine years in dystrophic grasslands. In both grassland types palatability increased with time since protection. In eutrophic sites the abundance of perennials showed a significant increase with time since protection, while the abundance of annuals showed a concomitant decrease. This relationship was not evident in dystrophic grasslands. Grass species diversity, basal cover and density showed no relationship with time since protection in the eutrophic sites, but a general increase with time since protection was found in dystrophic sites. Soil bulk density, field capacity, pH and soil nutrients showed no evidence of a relationship with time since protection for either grassland type, while soil porosity increased significantly with time since protection at eutrophic sites, but not dystrophic sites. These relatively rapid changes following the removal of the high grazing pressure indicate that these systems are characterized by relatively high resilience.

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1112. Response of a semidesert grassland to 16 years of rest from grazing.

Brady, W. W.; Stromberg, M. R.; Aldon, E. F.; Bonham, C. D.; and Henry, S. H.
Journal of Range Management 42(4): 284-288. (1989)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1989/424/4brad.pdf>
 Descriptors: pastures/ semiarid zones/ ecosystems/ grazing intensity/ plant communities/ botanical composition/ grazing/ Arizona
 This citation is from AGRICOLA.

1113. Response of the alpine gentian *Gentiana nivalis*: To protection from grazing by sheep.

Miller, G. R.; Geddes, C.; and Mardon, D. K.
Biological Conservation 87(3): 311-318. (1999)
 NAL Call #: S900.B5; ISSN: 0006-3207
 Descriptors: grazing/ plant density/ seedling establishment/ survival

Abstract: Protection from summer grazing by sheep was imposed experimentally from 1987 to 1996 on colonies of alpine gentian *Gentiana nivalis*, a rare montane annual growing in grassland at Ben Lawers National Nature Reserve. Alpine gentians on ungrazed plots grew taller and survived better than did plants in adjacent grazed plots. The density of plants on ungrazed plots was unaffected for three

years but thereafter declined. By 1996 it was only 20% of the density on grazed plots. Perennial vegetation responded to protection from sheep grazing by growing taller and denser. Ultimately it became 50-60 mm taller in the ungrazed plots than it was in the grazed plots. The spread of perennials also progressively reduced the amount of bare soil in the ungrazed plots-by 1996, it occupied a mere 0.2% there compared to 7% in the grazed plots. The loss of potential gaps for seedling establishment was probably the main cause of the decline in alpine gentian density on the ungrazed plots. The presence of sheep helps to maintain alpine gentian colonies in grassland.

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1114. Response of the mixed prairie to protection from grazing.

Willms, W. D.; Dormaar, J. F.; Adams, B. W.; and Douwes, H. E.
Journal of Range Management 55(3): 210-216. (2002)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
 Descriptors: prairies/ grazing intensity/ botanical composition/ soil depth/ soil chemistry/ biomass/ species diversity/ carbon/ nitrogen/ pH/ soil water/ A horizons/ phosphorus/ plant litter/ Alberta
Abstract: The Mixed Prairie plant communities developed with the influences of fire and grazing. Available evidence suggests that removal of these disturbances could cause succession toward a more mesic type with the accumulation or litter or loss in productivity as nutrient turnover is delayed. Exclosures constructed in 1927 in a semiarid Mixed Prairie community provided an opportunity to examine the effects that protection had on vegetation and soils. Fifteen exclosures were selected for detailed examination; of these, 11 were located on Chernozemic soil and 4 on Solonchic soil. We measured plant and soil variables both inside and outside the exclosures in a test of the hypothesis that protection from grazing will lead to a loss of production potential of the semi-arid. Mixed Prairie communities in the Northern Great Plains of southeastern Alberta. We found little evidence that 70 years of protection from large animal disturbance reduced the production potential of the plant communities. Conversely, most evidence suggested a neutral effect or an improvement as reflected in an increased cover of *Pascopyrum smithii* Rydb. (Love) ($P = 0.049$) and increased annual net primary production ($P = 0.047$). The effect of protection appeared largely driven by the accumulation of litter mass that primarily benefits soil and plant indices of quality on the Chernozemic soil type. Although protection tended to reduce species diversity ($P = 0.097$) among native plants on the Chernozemic soil type, evenness and richness were not affected ($P > 0.10$). The potential effect that reduced diversity might have on reducing production stability appears more than compensated for by increased litter mass.
 This citation is from AGRICOLA.

1115. Response of vegetation and breeding birds to the removal of cattle on the San Pedro River, Arizona (U.S.A.).

Krueper, D.; Bart, J.; and Rich, T. D.

Conservation Biology 17(2): 607-615. (2003)

NAL Call #: QH75.A1C5; ISSN: 0888-8892

Descriptors: riparian environments/ arid environments/ riparian vegetation/ agriculture/ abundance/ breeding success/ environment management/ nature conservation/ population density/ conservation/ Aves/ USA, Arizona, San Pedro R./ USA, Arizona/ birds/ cattle removal/ passeriformes/ landbirds/ songbirds

Abstract: In late 1987 cattle were removed from the San Pedro Riparian National Conservation Area (NCA) in southeastern Arizona (U.S.A.). We monitored vegetation density and abundance of birds during the breeding season during 1986-1990 in riparian, mesquite grassland, and Chihuahuan desert-scrub communities in the NCA. The density of herbaceous vegetation increased four- to six-fold in riparian and mesquite grassland communities. Little change occurred in herbaceous vegetation in desert scrub, or in the density of shrubs or trees in any of the communities. Of 61 bird species for which sufficient data were collected, mean detections per kilometer increased for 42 species, 26 significantly, and decreased for 19 species, 8 significantly. The number of individuals of all avian species detected on surveys increased each year from 103/kilometer in 1986 to 221/kilometer in 1991, an average annual increase of 23% ($p < 0.001$). The largest increases occurred in riparian species, open-cup nesters, Neotropical migrants, and insectivores. Species of the Chihuahuan desert-scrub, in which vegetation changed the least, showed the smallest increases. Only a few of the species showed increasing regional trends for the same period, as demonstrated by the North American Breeding Bird Survey; thus, increases on the San Pedro Riparian NCA were likely caused by the change in local conditions, not by regional effects. Our results suggest that removing cattle from riparian areas in the southwestern United States can have profound benefits for breeding birds.

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1116. Response of vegetation of the Northern Great Plains to precipitation amount and grazing intensity.

Olson, K. C.; White, R. S.; and Sindelar, B. W.

Journal of Range Management 38(4): 357-361. (1985)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1985/384/18olso.pdf>

Descriptors: plant ecology/ precipitation/ grazing intensity/ plant development/ climatic factors/ United States

This citation is from AGRICOLA.

1117. Response of wild wheat populations to grazing in mediterranean grasslands: The relative influence of defoliation, competition, mulch and genotype.

Noy Meir, I. and Briske, D. D.

Journal of Applied Ecology 39(2): 259-278. (2002)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: mediterranean grasslands/ biomass/ competition/ defoliation/ genotype/ grazing/ grazing tolerance/ intensive livestock grazing/ mulch/ mulch applications/ reproductive performance/ seedling emergence/ survival/ vegetative performance

Abstract: 1. Grassland management must be based on an understanding of key species' responses to various grazing

regimes to achieve both production and conservation objectives. An experiment was designed to investigate several population processes that may potentially (i) contribute to the decline of *Triticum dicoccoides* (wild wheat) in intensively grazed grasslands, and (ii) promote the persistence of wild wheat in these grazing regimes. 2. The experiment was conducted in natural Mediterranean grassland on the Korazim Plateau in northern Israel in the 1991-92 growing season. Nursery-grown seed of two morphologically distinct wild wheat genotypes were sown in plots with defined mulch applications and clipping regimes. 3. Mulch application did not affect seedling emergence or establishment, but it did reduce tiller number per plant and ear size compared with plants grown without mulch. The detrimental effects of mulch on plant performance throughout the growing season indicated that both radiation and nitrogen limitations may have contributed to growth suppression. Mulch application reduced wheat biomass to a greater extent than that of interspecific competitors. The negative response indicated that mulch removal by intensive grazing during the dry season was unlikely to contribute to the decline of wild wheat in response to intensive livestock grazing. 4. Both vegetative and reproductive performance of wild wheat increased by 50% in response to a reduction of interspecific competition following defoliation of neighbouring plants. A single severe clipping of vegetative wheat plants in defoliated neighbourhoods did not affect plant survival or tiller number, but did reduce ear and spikelet numbers and vegetative and reproductive biomass, compared with unclipped wheat plants. The positive wheat response to the reduction of interspecific competition almost exactly compensated for the negative effect of direct clipping on wheat fitness, and may thus contribute to the persistence of wheat populations. 5. A second severe clipping of wheat plants in the reproductive growth phase severely reduced plant survival to reproduction, reproductive biomass, and seed quantity and quality in those plants that did become reproductive. One-half of the ears initiated following late-season clipping did not emerge from the flag leaf and produced mostly thin seed with reduced germinability. 6. Genuiculate genotypes exhibited greater grazing tolerance and reproductive performance than the erect genotypes in response to the second severe clipping. An increase in the relative abundance of genuiculate genotypes in intensively grazed communities may provide an important persistence mechanism for wild wheat populations. 7. An integrated estimate of wild wheat fitness, calculated as the mean reproductive output per seed sown, was < 1 in plants clipped during the later phase of reproductive growth. This indicates that wheat populations would experience local extinction if this defoliation regime were continued for several successive years. 8. Management prescriptions to conserve this key annual species must focus on the reduction or deferment of late-season grazing during the reproductive growth phase to ensure population persistence.

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1118. Response to grazing after nine years of cattle exclusion in a Flooding Pampa grassland Argentina.

Facelli, J. M.

Vegetatio 78(1-2): 21-26. (1988)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: Dicotyledon propagule/ basal cover/ floristic composition/ community dynamics

Abstract: This paper reports on changes induced by the introduction of cattle in a grassland that had remained ungrazed for 9 yr, in comparison with two adjacent grasslands: one that remained enclosed and one that has been continuously subject to grazing. Basal cover was measured on 25 interception lines, each 1 m long, three times during one year. The variables studied were: total cover, cover of grasses and dicots, cover of creeping grasses, floristic composition, and dissimilarity among sites. At the first sampling, 2 yr after cattle re-introduction, the newly grazed site was more similar to the ungrazed than to the grazed site. The newly grazed site had very low cover of dicots; the species of dicots present were different from those found in the continuously grazed area. Creeping grasses had higher cover in the newly grazed site than in the other sites, and continued to increase. At the last sampling, one year later, the newly grazed site had become more similar to the continuously grazed site. Only after 5 yr of cattle grazing the exotic dicots that were dominant in the continuously grazed site, were recorded in the re-opened site. The absence of propagules of these species or the absence of safe sites may account for this delayed invasion.

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1119. The response to season, enclosure, and distance from water of three central Australian pasture types grazed by cattle.

Foran, B. D.; Bastin, G.; Remenga, E.; and Hyde, K. W.

Australian Rangeland Journal 4(1): 5-15. (1982)

NAL Call #: SF85.4.A8A97; ISSN: 0313-4555

Descriptors: grazing/ management/ grasslands

Abstract: Three central Australian pasture types (Mulga Annual, Mulga Perennial and Sandy Open Woodland) grazed by beef cattle were closed for 11 yr and detailed plant measurements were made over the last 7 yr. The closed land extended 3.2 km from permanent watering points. Rainfall during this period (1968-1979) varied from well above av. for 3 yr to near drought conditions. The above av. rainfall yr had a greater influence on yield, density and cover of the herbage layer than the experimental treatments of closure and distance from water. DM production varied from 217 kg to 2.38 t/ha. Plant density and cover were generally not affected by treatments although some plant spp. and spp. groups were affected.

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1120. Responses of a remnant California native bunchgrass population to grazing, burning and climatic variation.

Marty, Jaymee T.; Collinge, Sharon K.; and Rice, Kevin J.

Plant Ecology 181(1): 101-112. (2005)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: climatic variation/ grazing/ burning/ ungrazed/ light rotational grazing/ heavy rotational grazing/ continuously grazed

Abstract: This study examined the interactive effects of grazing intensity and burning on a remnant population of

the California native bunchgrass *Nassella pulchra*. We measured growth, reproduction and mortality of permanently marked bunchgrasses and measured bunchgrass seedling recruitment and density in permanent quadrats. We burned half of the treatment plots in late spring 1998. Grazing treatments were implemented in 1998, 1999 and 2000 at four different intensities: ungrazed, light rotational grazing (31% average biomass removal), heavy rotational grazing (42% average biomass removal), and continuously grazed. Both burning and grazing affected the bunchgrass population. Bunchgrass mortality was 10% higher in burned vs. unburned plots but was not significantly different among grazing treatments. Seedling density was 100% higher in burned vs. unburned plots 2 years after the burn, however seedling densities never attained pre-burn levels. Seedling densities did not differ significantly among grazing treatments, but grazing reduced the height and reproduction of the mature bunchgrasses. Adult bunchgrass density did not differ significantly in any of the treatments but experienced a five-fold decrease over the 4 years of the experiment. Although the continuous grazing treatment reduced the number of culms produced per plant by 75% from the baseline year, the effect on culm production in the continuous grazing treatment was not consistently greater than the rotational grazing treatments. The interaction of grazing and burning had no significant impacts on the *N. pulchra* populations except on the diameter of adult bunchgrasses which was highest in the lightly grazed, unburned treatments 2 years following the burn. All response variables except bunchgrass height followed a similar pattern in time over the 4 years of the experiment regardless of treatment, peaking in 1998 and then declining in 1999 and 2000. We believe the above average rainfall and below average temperatures experienced late in the growing season in 1998 provided conditions that favored the native bunchgrasses. Overall, we found few interactive effects of grazing and burning but the separate treatments did affect bunchgrass growth, reproduction and mortality, and these effects were modulated by the ubiquitous effects of climatic fluctuations.

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1121. Responses of birds, rodents, and vegetation to livestock enclosure in a semi desert grassland site.

Bock, C. E.; Bock, J. H.; Kenney, W. R.; and Hawthorne, V. M.

Journal of Range Management 37(3): 239-242. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/373/12bock.pdf>

Descriptors: *Bouteloua* spp./ *Eragrostis intermedia*/ *Trichachne californicum*/ shrub/ seasonality/ xeric habitat/ feeding/ grazing/ Arizona/ USA

Abstract: Livestock were excluded from a 3160-ha range in southeastern Arizona [USA] since 1968. Compared to an adjacent continuously grazed area, in 1981-1982 a protected upland site supported 45% more grass cover, a comparatively heterogeneous grass community and 4 times as many shrubs. Grama grasses (*Bouteloua* spp.) were equally common in and outside the enclosure, while a variety of other species, especially plains lovegrass (*Eragrostis intermedia*) and Arizona cottontop (*Trichachne californicum*) were much more abundant on the protected site. The grazed area supported significantly higher numbers of birds in summer, while densities did not differ in winter. Rodents were significantly more abundant inside the

protected area. Species of birds and rodents more common in the grazed area included those typical of more xeric lowland habitats and those preferring open ground for feeding. Species more common on the protected site were those which characterize semidesert or plains grasslands, and which prefer substantial grass or shrub cover. Grazing appeared to favor birds as a class over rodents.

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1122. The responses of blanket bog vegetation to controlled grazing by hill sheep.

Grant, S. A.; Bolton, G. R.; and Torvell, L.

Journal of Applied Ecology 22(3): 739-751. (1985)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: bogs/ ecosystems/ grazing/ habitat alterations/ Europe/ United Kingdom/ Scotland

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1123. Responses of flower phenology and seed production under cattle grazing impact in sandy grasslands.

Kratochwil, A.; Fock, S.; Remy, D.; and Schwabe-Kratochwil, A.

Phytocoenologia 32(4): 531-552. (2002)

NAL Call #: QK911.P52; ISSN: 0340-269X

Descriptors: Diantho-Armerietum/ generative regeneration/ sand vegetation complexes/ seed bank/ Spergulo-Corynephorum

Abstract: The impact of cattle grazing on selected characteristic and dominant plant species of three sandy grassland communities in northwestern Germany (Spergulo-Corynephorum typicum, S.-C. cladonietosum and Diantho-Armerietum) is investigated with regard to the loss of above-ground diaspores in the course of a vegetation period. Special attention is given to the importance of the seed bank in the soil as compensation potential. The flower and fruit phenology of the plant species was analyzed by counting. A fence was erected so that data samples outside and within an enclosure could be compared. Extracted soil samples and a germination test give information about the diaspore reservoir in the soil at the beginning of the investigation. The comparison of grazed and ungrazed stands yielded the following results. The Spergulo-Corynephorum typicum is poor, the S.-C. cladonietosum richer in palatable inflorescences and infructescences (e.g. *Carex arenaria*). In the former only 12-24% of the inflorescences and infructescences are grazed (*Carex arenaria*, *Corynephorus canescens*), in the latter 45-51% (*Carex arenaria*). The Spergulo-Corynephorum can regenerate itself from the diaspore potential to a slight extent if there are gaps, e.g. caused by cattle trampling. The Diantho-Armerietum is quite intensively grazed, entailing a major reduction of flowers and fruits of certain plant species (*Agrostis capillaris*: inflorescences by 71%, infructescences 72%, *Dianthus deltoides*: flowers by 61%, fruits 22%). In contrast, two species increase flower and fruit numbers (by 36-77%) in the grazed sites (*Agrostis vinealis*, *Ranunculus bulbosus*). Faeces microsites are important elements for patch dynamic systems in the Diantho-Armerietum. At faeces microsites in the Diantho-Armerietum, which constitute about one-third of the plot areas, many flowers and fruits develop. Flower and fruit development at the faeces microsites and the seed bank in the soil ensure a generative regeneration of the Diantho-Armerietum. Gap

dynamics, patch dynamics of faeces microsites and seed bank processes are driving forces for the generative regeneration of the investigated plant communities.

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1124. Responses of herbage and browse production to six range management strategies.

Sanderson H. R.; Quigley T. M.; and Tiedemann A. R. Portland, Or.: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station; PNW-RP-419, 1990. 15 p.

Notes: ISSN 0882-5165

NAL Call #: A99.9 F7625Uni no.419

http://www.fs.fed.us/pnw/pubs/pnw_rp419.pdf

Descriptors: range management--Oregon/ grazing--Oregon/ browse--Oregon

This citation is from AGRICOLA.

1125. Responses of two semiarid rangeland communities to protection from grazing.

Noy Meir, I.

Israel Journal of Botany Basic and Applied Plant Sciences 39(4-6): 431-442. (1990)

NAL Call #: 450 Is7; ISSN: 0021-213X

Descriptors: Noaea mucronata/ Asphodelus aestivus/ Poa bulbosa/ sheep/ goat/ biomass/ species composition

Abstract: Changes in vegetation following protection from grazing were observed at two sites in semiarid rangelands in Israel with a long history of continuous grazing by sheep and goats. Near Jerusalem, a new enclosure was fenced off; the changes in biomass and species composition within this enclosure, in comparison with an adjacent grazed area, were followed for two growing seasons. The vegetation was initially dominated by *Poa bulbosa* and prostrate annuals. For most of the first growing season, there was surprisingly little difference in biomass and species composition. During the dry season, plant litter and seeds remained largely intact on the surface in the enclosure, but were almost entirely removed by grazers outside it. During the second growing season, biomass in the enclosure was usually double that outside; the increase was mostly due to large-seeded annual grasses. Near Beer Sheva, the effects on the vegetation of 5-6 years of protection from grazing were recorded at two enclosure fences. Annuals were equally sparse on both sides of the fence, though species composition was different. The biomass of perennials was double inside the enclosure, mainly due to an increase in the biomass of *Noaea mucronata* and perennial thistles. Most perennial species, except *Asphodelus aestivus*, were more abundant inside the enclosure than in the grazed area.

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1126. Responses of vegetation and cattle to various systems of grazing on seeded and native mountain rangelands in eastern Utah.

Laycock, W. A. and Conrad, P. W.

Journal of Range Management 34(1): 52-58. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/34/1/15layc.pdf>

Descriptors: Agropyron spp./ Artemisia/ Bromus inermis/ species composition/ cover production/ rest rotation

Abstract: Several grazing systems were compared on the Diamond Mountain Cattle Allotment of the Ashley National Forest in Utah. The area is .apprx. 8000 ft in elevation and

receives 20-25 in. of precipitation annually. On native sagebrush[Artemisia]-grass range, a comparison of summer-long (July-Sept.) grazing every year, summer-long in alternate years, and 3-unit rest-rotation systems revealed no differences between systems in cover, production or species composition of vegetation after 7 yr of grazing. Average daily gains of cattle over the entire period were the same for all systems. During the period of study on this range, which was in fair to good condition and grazed at a moderate intensity, rest-rotation was not a better system than summer-long grazing. The key to this lack of difference was management. Rest-rotation systems require intensive management of water, salt, riding, etc. All units in both systems in the study had good distribution of water and salt and adequate riding to insure uniform cattle distribution. The unit grazed summer-long every year received the same degree of management and thus remained as productive as ranges under rest-rotation management. On seeded units of the allotment, heavy grazing in June in alternate years increased production on areas dominated by crested wheatgrass [Agropyron spp.] and smooth brome [Bromus inermis].
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1127. Restorative grazing as a tool for directed succession with diaspore inoculation: The model of sand ecosystems.

Stroh, Michael; Storm, Christian; Zehm, Andreas; and Schwabe, Angelika
Phytocoenologia 32(4): 595-625. (2002)
NAL Call #: QK911.P52; ISSN: 0340-269X
Descriptors: diaspore inoculation: applied and field techniques/ restorative grazing: applied and field techniques/ Festuco-Brometea/ Koelerio-Coryneporetea/ directed succession/ sand ecosystems
Abstract: In this study we examine the restoration of sand grassland target communities (belonging to Koelerio-Coryneporetea, Festuco-Brometea) on bare ground. A field experiment was established in 1998. Soil seed bank and seed rain were assessed. Directed and spontaneous succession was monitored for 3 years. For diaspore transfer (inoculation) 1. mown material, 2. raked material or 3. sods from intact sand habitats were used. The experimental plots were grazed by sheep from 1999 to 2001; in 2001 also by donkeys. Comparisons with grazed-only plots and controls were made. Additionally, spontaneous succession was determined in two non-managed sand grassland plots. Spontaneous succession leads to ruderal communities (first Stellarietea phase, followed by increasing dominance of Artemisietea and Agropyretea species, e.g. *Poa angustifolia*, *Calamagrostis epigejos*). A few target species were able to establish themselves, but they play a minor role, because they are only present in small numbers in both soil seed bank and seed rain. Grazing-only (without inoculation) is not sufficient to stop the ruderalisation trend. However, after each of the three diaspore inoculation treatments nearly all target species established themselves. Ruderalisation was suppressed by inoculation combined with grazing. Nevertheless, many ruderal species occur and represent a latent ruderalisation potential. Ruderal species are grazed preferentially by sheep. Several ruderal species that are rejected by sheep are grazed by donkeys (e.g. *Cirsium arvense*, *Calamagrostis epigejos*). A compensation for biomass loss after grazing (as supposed by the grazing

optimization hypothesis) was not observed (except for some perennial Fabaceae species). Thus, grazing appears to be a suitable measure to inhibit ruderalisation. Most sand-specific, endangered species are not grazed and thus are able to spread. The analysis of plant tissue has shown that sheep prefer nitrogen-rich plant species (Fabaceae) and plant parts > 2 % N. Plant parts containing < 1 % N are avoided. This may enhance oligotrophication of ruderalised habitats and alter ecosystem functions.
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1128. Results from the use of a system of "rest rotational grazing" for livestock to improve wildlife habitat in Montana.

Mccarthy, J. J.
Ibex Journal of Mountain Studies 7(Supplement): 13-16. (2003); ISSN: 1590-3907
Descriptors: animals and man/ disturbance by man/ commercial activities/ conservation/ conservation measures/ habitat/ land zones/ Nearctic Region/ USA/ North America/ *Cervus canadensis* (Cervidae): farming and agriculture/ rest rotation grazing system/ rangeland management impact on habitat quality/ habitat management/ terrestrial habitat/ rangeland/ Montana/ rangeland grazing management impact on habitat quality/ Cervidae/ Artiodactyla/ Mammalia/ chordates/ mammals/ ungulates/ vertebrates
Abstract: Rest rotation grazing is a forage management system that utilizes livestock grazing to improve forage vigor, reduce erosion and improve range conditions. Cyclic movement of livestock through pastures allow plants to carry out photosynthetic processes and assist in seed dissemination and seedling establishment. Elements of such a grazing system are discussed, as are the benefits to plants and soils. An example of a system that has been in operation since 1980 is also described, as are the benefits to livestock producers and the area's wildlife.
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1129. Riparian grazing management that worked: Introduction and winter grazing.

Masters, L.; Swanson, S.; and Burkhardt, W.
Rangelands 18(5): 192-195. (1996)
NAL Call #: SF85.A1R32; ISSN: 0190-0528.
Notes: Subtitle: [Part] I.
Descriptors: grassland management/ seasonal variation/ grazing/ erosion/ revegetation/ grasslands/ riparian grasslands/ rangelands/ grazing systems/ range management/ management/ cattle/ United States/ Nevada/ Bos/ Bovidae/ ruminants/ Artiodactyla/ mammals/ vertebrates/ Chordata/ animals/ ungulates/ North America/ America/ Developed Countries/ OECD Countries/ Mountain States of USA/ Western States of USA/ United States
Abstract: A review is presented of traditional and alternative grazing strategies for riparian ecosystems. Rotation and rest strategies are highlighted in addition to other herd management techniques such as animal selection, riding, slating and water development. Winter grazing is discussed in relation to the resulting improvement of livestock distribution and plant response, Wickiup Creek and Meadow Valley Wash (both in Nevada), being discussed as examples of the success of this management type. These sites contrast in elevation, vegetation, precipitation patterns and their historical uses,

but winter grazing proved successful in restoring streamside vegetation, maintaining healthy conditions and building new stream channels in both areas.

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1130. Riparian grazing management that worked: Rotation with and without rest and riparian pastures.

Masters, L.; Swanson, S.; and Burkhardt, W.

Rangelands 18(5): 196-200. (1996)

NAL Call #: SF85.A1R32; ISSN: 0190-0528

Descriptors: rotational grazing

This citation is from AGRICOLA.

1131. Riparian livestock enclosure research in the western United States: A critique and some recommendations.

Sarr, Daniel A.

Environmental Management 30(4): 516-526. (2002)

NAL Call #: HC79.E5E5; ISSN: 0364-152X

Descriptors: animal (Animalia): aquatic, terrestrial/ Animals/ Humpty Dumpty model/ agenda laden literature reviews/ broken leg model/ critical reviews/ ecosystem recovery: mechanisms, scales/ geomorphology/ improved enclosure placement/ design/ long term research programs: development/ meta analyses/ post exclusion dynamics/ pre treatment data: collection/ restoration ecology/ riparian ecosystem ecology: livestock impact susceptibility/ riparian livestock enclosure research: critique, recommendations/ rubber band model/ study popularization/ unifying conceptual framework/ vegetation/ weak study designs

Abstract: Over the last three decades, livestock enclosure research has emerged as a preferred method to evaluate the ecology of riparian ecosystems and their susceptibility to livestock impacts. This research has addressed the effects of livestock exclusion on many characteristics of riparian ecosystems, including vegetation, aquatic and terrestrial animals, and geomorphology. This paper reviews, critiques, and provides recommendations for the improvement of riparian livestock enclosure research. Enclosure-based research has left considerable scientific uncertainty due to popularization of relatively few studies, weak study designs, a poor understanding of the scales and mechanisms of ecosystem recovery, and selective, agenda-laden literature reviews advocating for or against public lands livestock grazing. Enclosures are often too small (<50 ha) and improperly placed to accurately measure the responses of aquatic organisms or geomorphic processes to livestock removal. Depending upon the site conditions when and where livestock enclosures are established, postexclusion dynamics may vary considerably. Systems can recover quickly and predictably with livestock removal (the "rubber band" model), fail to recover due to changes in system structure or function (the "Humpty Dumpty" model), or recover slowly and remain more sensitive to livestock impacts than they were before grazing was initiated (the "broken leg" model). Several initial ideas for strengthening the scientific basis for livestock enclosure research are presented: (1) incorporation of meta-analyses and critical reviews; (2) use of restoration ecology as a unifying conceptual framework; (3) development of long-term research programs; (4) improved enclosure placement/design; and (5) a stronger commitment to collection of pre-treatment data.

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1132. Riparian vegetation response to different intensities and seasons of grazing.

Lucas, R. W.; Baker, T. T.; Wood, M. K.; Allison, C. D.; and Vanleeuwen, D. M.

Journal of Range Management 57(5):

466-474. (Sept. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: riparian areas/ grazing intensity/ species diversity/ seasonal variation/ herbaceous plants/ regrowth/ New Mexico

Abstract: Sustainable management of riparian ecosystems depends on our understanding of these complex systems. Thus far, the scientific literature has not adequately addressed the effects of livestock grazing on riparian areas in the American southwest. Most available information is observational, anecdotal, based on unreplicated experiments, or compares heavily grazed areas to areas from which livestock have been completely excluded. This study, in the Black Range of western New Mexico, compared effects of different seasons of use (cool season, warm season, and dormant season) and grazing intensities (light, moderate, and none) of cattle on young narrowleaf cottonwood (*Populus angustifolia* James) populations, and herbaceous vegetation in 2 adjacent southwestern riparian areas. Cottonwoods in lightly grazed and moderately grazed plots received significantly greater use than cottonwoods in ungrazed plots which experienced negligible grazing pressure. Increased grazing pressure did not have significant impacts on cottonwood populations. Effects of season of use were significant on both herbaceous species richness and diversity. We conclude that no single riparian area management approach is best in all situations, but the grazing treatments used in this study appear to have been successful at maintaining riparian communities.

This citation is from AGRICOLA.

1133. The role of grazing in agropastoral systems in the Mediterranean region and their environmental sustainability.

Enne, Giuseppe; Zucca, Claudio; Montoldi, Anna; and Noe, Lorenzo

Advances in Geoecology 37: 29-46. (2004);

ISSN: 0722-0723.

Notes: Meeting Information: Symposium on Sustainability of Dehesas, Montados and other Agrosilvopastoral Systems, Caceres, SPAIN; September 21 -24, 2003

Descriptors: desertification/ grazing/ environmental impact/ environmental sustainability/ land suitability/ agropastoral system/ optimal stocking rate

Abstract: Agro-pastoral systems have significantly contributed in shaping the landscapes of the Mediterranean basin. These systems vary widely according to the differing climatic, cultural and socio-economic conditions under which they developed; from the Parours of the Maghreb steppes to the dehesas in the Iberian peninsula, and from the Mediterranean islands to inland mountain regions. Their present particularities developed both in response to internal needs within the farming systems (need to increase production while reducing costs) and external forces (competition with other activities for the use of land). In many cases recent changes evolved from increased grazing. Overgrazing represents one of the causes for desertification in many areas of the Mediterranean region. To mitigate this problem a better knowledge of agropastoral

systems is first needed. Then, methods must be devised to model and assess environmental impacts, land suitability to grazing, and optimal stocking rate.

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1134. Role of grazing in Mediterranean rangeland ecosystems: Inversion of a paradigm.

Perevolotsky, A. and Seligman, N. G.

BioScience 48(12): 1007-1017. (1998)

NAL Call #: 500 Am322A; ISSN: 0006-3568

Descriptors: grazing/ ecosystems/ grasslands/ Mediterranean grasslands/ rangelands/ nature reserves/ overgrazing/ environmental degradation/ plant communities/ nature conservation/ plant succession/ forest fires/ fire danger/ fire causes/ scrublands/ range management/ plant genetic resources/ wildfires-

Abstract: The popular consensus that characterizes the intensive use of rangelands surrounding the Mediterranean Basin as overgrazing and the altered landscape as degraded is challenged as an oversimplification. It is suggested that heavy grazing in this region may be an efficient and ecologically sound method of land use.

Equating major ecosystem changes with degradation is considered questionable, being based on vegetation structure rather than on species richness and diversity, productivity and utility to society. Where grazing is excluded, impenetrable thickets develop with low species diversity which are increasingly vulnerable to uncontrollable fires. Increasing depopulation of Mediterranean rangelands has resulted in the loss of desirable characteristics from the landscape. Attitudes to change in Mediterranean rangelands are shown to depend on human viewpoint. It is suggested that the main factor responsible for change is human settlement and land clearance from 7000 BC onwards, and that grazed ecosystems are better adapted to this change than other ecosystems which have disappeared. The rangeland vegetation of the Mediterranean basin is described briefly and the effects of grazing on vegetation structure, water and soil, plant species richness, botanical composition, primary and secondary production, plasticity and resilience, and likelihood of wildfire are discussed. Grazing is recommended as a management tool in these rangelands and the reduction in grazing caused by human depopulation considered a greater threat than overgrazing.

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1135. Scale-dependent effects of grazing on rangeland degradation in northern Kenya: A test of equilibrium and non-equilibrium hypotheses.

Oba, G.; Weladji, R. B.; Lusigi, W. J.; and Stenseth, N. C.

Land Degradation and Development 14(1): 83-94. (2003)

NAL Call #: S622.L26; ISSN: 1085-3278

Descriptors: equilibrium grazing model: mathematical and computer techniques/ non equilibrium grazing model: mathematical and computer techniques/ scale dependence analysis: mathematical and computer techniques/ biomass production/ grazing pressure/ rangeland degradation/ seasonality/ species richness

Abstract: This study employs scale-dependence as an analytical approach to understanding effects of livestock grazing on rangeland degradation in northern Kenya. It used extensive datasets previously collected from 13 200 km² rangelands where grazing pressure gradients of livestock (varied from none, light, moderate, heavy and very

heavy grazing) in conjunction with seasonality across different ecological scales influenced plant responses and probably contributed to land degradation. The data representing spatial and temporal scales were used to test the equilibrium and non-equilibrium-grazing models and to verify scales at which the models appropriately described range degradation. The equilibrium-grazing models operated at the coarse scales (e.g. range units, km²) and non-equilibrium-grazing models at multiple scales (e.g. spatial, temporal and fine scales-plots, landscape patches). The study showed that the equilibrium-grazing hypothesis, which stated that responses of plant species richness, cover and biomass varied along grazing pressure gradients at the coarse scale, was rejected, while the non-equilibrium-grazing hypothesis, which stated that the factors responded to temporal and spatial scales combined with grazing pressure gradients at the fine scale, was accepted. This study emphasized that in future discussions on shifts in the thinking of range science from equilibrium- to non-equilibrium-grazing models should clarify scales at which land degradation is assessed. In conclusion, the paper suggests that understanding plant species responses to grazing pressure and seasonality needs to consider multiple scale effects and that the dogmatic notions about degradation of the arid zone rangelands at the coarse scales should be reconsidered. Land degradation assessments in the arid zones should focus at the fine scale.

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1136. Seasonal changes in nutrient content under three defoliation treatments in two coastal grassland communities of Transkei.

Shackleton, C. M. and Mentis, M. T.

Journal of the Grassland Society of Southern Africa 9(1): 30-37. (1992)

NAL Call #: SB197.J68; ISSN: 0256-6702

Descriptors: crude protein/ dry matter digestibility/ phosphorus/ potassium/ calcium/ magnesium/ resource management/ grazing/ burning/ plant growth/ South Africa

Abstract: Changes in nutrient concentrations were monitored over a two-year period in two coastal grassland communities. Dry matter digestibility, crude proteins, phosphorus, potassium, calcium and magnesium were determined from handclipped samples of experimental treatments; namely, burning with and without subsequent grazing and protection from defoliation. Marked seasonal variations were evident in crude protein, dry matter digestibility, phosphorus and potassium. Defoliation treatment effects were superimposed on the seasonal changes. Burning stimulated large increases in crude protein, dry matter digestibility, phosphorus and potassium. Grazing led to higher protein levels, no change in dry matter digestibility and variable responses in mineral concentrations. Crude protein and phosphorus concentrations were frequently below the maintenance requirements for a LSU. In terms of nutrient stocks, optimum grazing conditions for growth existed only 5-6 months following a fire.

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1137. Seasonal wetlands and livestock grazing on the Missouri coteau: Aboveground biomass.

Mings, T. S.; Kirby, D. R.; and Green, D. M.
Proceedings of the North Dakota Academy of Science 43: 63. (Apr. 1989)
 NAL Call #: 500 N813; ISSN: 0096-9214
 Descriptors: livestock/ grazing/ range management/ wetlands/ Missouri
 This citation is from AGRICOLA.

1138. Sheep and cattle grazing strategies on riparian-stream environments.

Platts, W. S.
 In: *Proceedings of the Wildlife-Livestock Relationships Symposium*. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 251-270; 1982.
 NAL Call #: SF84.84.W5 1981
 Descriptors: Idaho
 This citation is from AGRICOLA.

1139. Sheep grazing and riparian and watershed management.

Glimp, H. A. and Swanson, S. R.
Sheep Research Journal Special Issue: 65-71. (1994)
 NAL Call #: SF371.R47; ISSN: 1057-1809
 Descriptors: sheep/ watershed management/ range management/ runoff/ water quality/ grazing intensity/ riparian buffers/ literature reviews
 This citation is from AGRICOLA.

1140. Sheep grazing as a brush and fine fire fuel management tool.

Taylor, C. A.
Sheep Research Journal: 92-96. (1994)
 NAL Call #: SF371.R47; ISSN: 1057-1809
 Descriptors: sheep/ grazing/ rangelands/ fire fighting/ woody plants/ botanical composition/ species diversity/ feeding preferences/ brush control/ prescribed burning/ stocking rate
 This citation is from AGRICOLA.

1141. Sheep grazing as a range improvement tool.

Havstad, K. M.
Sheep Research Journal: 72-78. (1994)
 NAL Call #: SF371.R47; ISSN: 1057-1809.
 Notes: Special issue: Role of sheep grazing in natural resource management. Includes references.
 Descriptors: sheep/ range management/ grazing intensity/ grazing effects/ herbivores/ plant succession/ controlled grazing/ literature reviews
 This citation is from AGRICOLA.

1142. Sheep grazing as management tool in western European saltmarshes.

Bouchard, V.; Tessier, M.; Digaire, F.; Digaire, J. P.; Valery, L.; Gloaguen, J. C.; and Lefeuvre, J. C.
Comptes Rendus Biologies 326(Supplement 1): 148-157. (2003)
 NAL Call #: Q2 .C6; ISSN: 1631-0691.
 Notes: Conference: Biodiversity conservation and management, France, 4-7 Jul 2002
 Descriptors: salt marshes/ plant populations/ halophytes/ community composition/ species diversity/ environment

management/ biotic factors/ grazing/ herbivores/ nature conservation/ bays/ Tracheophyta/ France, St-Malo Gulf, Mont-St-Michel Bay/ sheep

Abstract: The effects of sheep grazing on plant community structure and diversity were studied in saltmarshes of the Mont-Saint-Michel bay. This study took place at two scales: (1) at the scale of the entire bay to explore the changes in plant community over a ten year period; and (2) locally with the use of experimental enclosure set up to mimic the abandonment of grazing. Moderate grazing generally enhanced plant richness and diversity, while the absence of grazing and overgrazing lead to a decrease in diversity and richness. The development of management strategies is becoming critical to preserve the diversity of saltmarshes functions.

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1143. Short-term effects of cattle exclusion on riparian vegetation in southeastern Kansas.

Hoover, David E.; Gipson, Philip S.; Pontius, Jeffrey S.; and Hynek, Alan E.

Transactions of the Kansas Academy of Science 104(3-4): 212-222. (2001)

NAL Call #: 500 K13T; ISSN: 0022-8443

Descriptors: Kansas Army Ammunition Plant/ cattle exclusion/ closed canopy riparian woodlands/ grazing/ litter/ riparian vegetation/ short term effects/ understory/ vegetation height

Abstract: Effects of cattle exclusion on the structure and composition of riparian vegetation were observed in a 2-yr study in southeastern Kansas. The study was conducted within riparian habitats on the 5,263-ha Kansas Army Ammunition Plant in north-central Labette County, Kansas. Three grazed and three ungrazed riparian areas were sampled in 1996 and 1997 to monitor vegetation changes in response to livestock exclusion. Total understory, grass, and litter cover were significantly different between the grazed and ungrazed study sites with mean cover estimates being higher (16.3%, 14%, and 12.1% greater respectively) in the ungrazed sites. A significant difference in the percentage of bare ground was observed between the grazed (24.6%) and ungrazed (12.5%) study sites. No difference in herbaceous vegetation height was detected between study sites in 1996. In 1997, mean herbaceous vegetation height differed significantly from 1996 (study sites combined) and was greater (95.6 cm vs. 65.6 cm) in the ungrazed study sites. Excluding cattle from closed canopy riparian woodlands in southeastern Kansas resulted in a positive short-term response of understory herbaceous vegetation. Our results suggest that riparian fencing may be an effective management tool for restoring understory vegetation in riparian communities grazed by cattle in the eastern Great Plains.

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1144. Short-term response of riparian vegetation to 4 grazing treatments.

Popolizio, C. A.; Goetz, H.; and Chapman, P. L.

Journal of Range Management 47(1): 48-53. (1994)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1994/471/10popo.pdf>

Descriptors: grazing/ plant communities/ botanical composition/ leaves/ national forests/ riparian buffers/ Colorado

Abstract: The Sheep Creek watershed of northcentral Colorado provided an ideal site to collect baseline trend data and to estimate foliar cover responses of montane riparian vegetation. Percent relative cover data were compared with Sorensen's similarity index and were analyzed with a 2-stage nested analysis of variance (ANOVA) to assess differences among 4 grazing treatments: long-term grazing (G), protection from livestock grazing since 1956 (P), recent protection following long-term grazing (P88), and recent livestock grazing following protection (G88). This study utilized 3 replications of each treatment. Data were collected in August 1988, June 1989, and August 1989, employing permanent and randomly placed transects and plots. When percent foliar cover means were paired using Sorensen's similarity index, long-term grazing and short-term grazing treatments were least similar in August 1988. Long-term protection and short-term grazing were most similar in June 1989. Average percent cover of bare ground, common dandelion (*Taraxacum officinale* Wiggers), white Dutch clover (*Trifolium repens* L.), and legumes grouped as lifeforms were significantly different among treatments, with long-term grazing being significantly different from long-term protection. Average sedge and forb cover was least affected. However, responses of individual sedge species varied with treatments. Average percent grass cover increased under short-term protection after a history of long-term grazing. Short-term grazing stimulated foliar cover of forbs, grasses, and sedges after more than 30 years of cattle exclusion.

This citation is from AGRICOLA.

1145. Short-term response of vegetation to cattle grazing in an abandoned orchard in southwestern Japan.

Hayashi, K.; Ikeda, K.; Ueda, A.; Fumita, T.; Etoh, T.; and Gotoh, T.

Asian Australasian Journal of Animal Sciences 19(4): 514-520. (2006)

NAL Call #: SF55.A78A7; ISSN: 1011-2367

Descriptors: stocking rate/ grazing response/ abandoned orchard

Abstract: An abandoned mandarin orange orchard in southwestern Japan was set-stocked by Japanese Black cows at two stocking rates (1.0 and 2.0 animals/ha), and vegetation dynamics and diet selection by cattle were monitored for two years, in effort to obtain information on effective use of abandoned agricultural fields for low-cost animal production and environmental consideration. Two dominant species at the commencement of grazing, kudzu (*Pueraria lobata* Ohwi) and tall goldenrod (*Solidago alissima* L.), showed different responses to grazing during the two years, the composition of kudzu decreased, contrasting with that of tall goldenrod which increased at both stocking rates. This was caused by high preference for kudzu and avoidance or low preference for tall goldenrod by cattle. Retrogression of vegetation due to cattle disturbances occurred at both stocking rates, with the high stocking rate leading to a lower degree of succession than the low stocking rate. It was shown that cattle grazing, particularly at a high stocking rate, was effective in the management of vegetation of an abandoned orchard.

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1146. Shrub densities in relation to fire, livestock grazing, and precipitation in an Arizona desert grassland.

Bock, C. E. and Bock, J. H.

Southwestern Naturalist 42(2): 188-193. (1997)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: population density/ grazing/ fires/ rainfall/ precipitation/ shrubs/ livestock/ forest fires/ arid lands/ *Haplopappus tenuisectus*/ USA, Arizona/ woody vegetation/ *Baccharis pteranioides*/ fires

Abstract: Changes in *Baccharis pteranioides* and *Haplopappus tenuisectus* densities in a southeastern Arizona grassland were related to patterns of livestock grazing, fire, and precipitation. Results suggested that both species increased following two periods of relatively wet winters, and declined during an intervening dry period. *Baccharis* completely recovered through vegetative regrowth in one year after a 1987 wildfire, but *Haplopappus* suffered nearly total fire-caused mortality, and had not recovered by 1995 compared to its abundance on a nearby unburned site. In 1995, both species were most abundant in areas protected from grazing. Long-term (1982-1995) densities of *Baccharis* were stable, but *Haplopappus* density increased by more than two orders of magnitude over the same period, except in the burned area.

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1147. Simulated long-term vegetation response to grazing heterogeneity in semi-arid rangelands.

Weber, Gerhard E.; Jeltsch, Florian; Van Rooyen, Noel; and Milton, Suzanne J.

Journal of Applied Ecology 35(5): 687-699. (1998)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: grazing heterogeneity: vegetation response/ grid based model: life history, plant biomass production, resource competition/ semi arid rangeland: habitat

Abstract: 1. The long-term effects of small-scale spatial heterogeneity of livestock grazing on vegetation dynamics were studied with a grid-based model of major life forms of savanna vegetation. Based on southern Kalahari ecology, the model includes stochastic life-history variables, resource competition for soil water, and biomass production for annuals, perennial grasses and shrubs. 2. Grazed at individual severities, the model's 25 m² grid cells defined the spatial scale of heterogeneity. Different scenarios of grazing heterogeneity were generated by modifying distributional and behavioural features of the grazing model. Simulations were run over 50 years under moderate to high constant stocking rates. 3. Results confirmed a previously reported threshold response of shrub cover increase: under moderate grazing pressure, little change in shrub cover occurred; when grazing pressure exceeded a threshold, shrub cover increased drastically. 4. Under moderate or high stocking rates, grazing heterogeneity did not modify grazing effects. However, within an intermediate range of stocking rates, small-scale heterogeneity determined the long-term impact of grazing. In particular, utilization intensity at the threshold of shrub cover increase was 60% less under high compared to low local grazing heterogeneity. 5. Sensitivity of vegetation dynamics to local grazing heterogeneity was also exemplified under a landscape-scale grazing gradient as observed at watering points: at a given utilization intensity, a wide zone of increased shrub cover occurred under large local grazing heterogeneity, while under the least heterogeneous grazing

only a narrow zone of slightly increased shrub cover occurred. 6. Because of the slow progress of shrub cover increase, a mismatch of management and ecological time scales was diagnosed and its implications for management are discussed. 7. We conclude that knowledge of local grazing heterogeneity is crucial for correct assessment of livestock impact on vegetation dynamics. Consequently, management aiming at sustainable land use should account for spatial grazing aspects. These poorly understood aspects form a gap to be filled by both empirical and theoretical studies.

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1148. Simulation of rotational grazing to evaluate integrated pest management strategies for *Boophilus microplus* (Acari: Ixodidae) in Venezuela.

Hernandez A. F.; Teel, P. D.; Corson, M. S.; and Grant, W. E.

Veterinary Parasitology 92(2): 139-149. (2000)

NAL Call #: SF810.V4; ISSN: 0304-4017

Descriptors: rotational grazing simulation model: mathematical model/ integrated pest management strategies

Abstract: Ranchers in Venezuela historically have controlled the cattle-fever tick, *Boophilus microplus* (Canestrini), with acaricide treatments of cattle but no technical planning. We developed a simulation model to evaluate cattle-tick population dynamics in systematic pasture rotation systems and Integrated Pest Management (IPM) approaches to managing ticks in the tropical dry-forest ecological zone of Venezuela. Model output showed five generations of cattle-ticks produced each year throughout the dry and rainy seasons that occur in this zone. Sensitivity analyses showed disproportionately large changes in on-host *B. microplus* populations in response to small changes in larval mortality rates, such as those resulting from differences in the innate resistance of cattle to tick parasitism. Simulation results with 1-6 pasture systems suggest that adjusting the graze:rest sequence with systematic rotation among 4-6 pastures could suppress, but not eradicate, tick populations.

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1149. Simulation of vegetation dynamics and management strategies on south Texas, semi-arid rangeland.

Glasscock, Selma N.; Grant, William E.; and Drawe, D. Lynn

Journal of Environmental Management 75(4): 379-397. (2005)

NAL Call #: HC75.E5J6; ISSN: 0301-4797

Descriptors: brush burning: applied and field techniques/ vegetation dynamics/ livestock grazing/ management strategy/ seasonal dynamic/ semi arid rangeland

Abstract: In this paper, we describe a model designed to simulate seasonal dynamics of warm and cool season grasses and forbs, as well as the dynamics of woody plant succession through five seral stages, in each of nine different plant communities on the Rob and Bessie Welder Wildlife Refuge. The Welder Wildlife Refuge (WWR) is located in the Gulf Coastal Prairies and Marshes ecoregion of Texas. The model utilizes and integrates data from a wide array of research projects that have occurred in south Texas and WWR. It is designed to investigate the effects of alternative livestock grazing programs and brush control

practices, with particular emphasis on prescribed burning, the preferred treatment for brush on the WWR. We evaluated the model by simulating changes in the plant communities under historical (1974-2000) temperature, rainfall, livestock grazing rotation, and brush control regimes, and comparing simulation results to field data on herbaceous biomass and brush canopy cover collected on the WWR over the same period. We then used the model to simulate the effects of 13 alternative management schemes, under each of four weather regimes, over the next 25 years. We found that over the simulation period, years 1974-2000, the model does well in simulating the magnitude and seasonality of herbaceous biomass production and changes in percent brush canopy cover on the WWR. It also does well in simulating the effects of variations in cattle stocking rates, grazing rotation programs, and brush control regimes on plant communities, thus providing insight into the combined effects of temperature, precipitation, cattle stocking rates, grazing rotation programs, and brush control on the overall productivity and state of woody plant succession on the WWR. Simulation of alternative management schemes suggests that brush canopy removal differs little between summer and winter prescribed burn treatments when precipitation remains near the long-term average, but during periods of low precipitation canopy removal is greater under winter prescribed burning. The model provides a useful tool to assist refuge personnel with developing long-term brush management and livestock grazing strategies. (c) 2005 Elsevier Ltd. All rights reserved. © The Thomson Corporation

1150. Site productivity and plant size explain the response of annual species to grazing exclusion in a Mediterranean semi-arid rangeland.

Osem, Y.; Perevolotsky, A.; and Kigel, J.

Journal of Ecology 92(2): 297-309. (2004)

NAL Call #: 450 J829; ISSN: 0022-0477

Descriptors: Mediterranean climate/ semiarid zones/ rangelands/ grazing management/ grazing intensity/ plant communities/ community structure/ topography/ Israel

Abstract: 1. The response of an annual plant community to protection from grazing as a function of variation in site productivity was studied in a semi-arid Mediterranean rangeland in Israel over 4 years (1996-99). The abundance of species was compared in grazed vs. ungrazed plots (exclosures) in four neighbouring topographic sites (south- and north-facing slopes, hilltop and Wadi shoulders), representing a gradient of resource availability and productivity. 2. Above-ground potential productivity at peak standing crop in spring (i.e. inside exclosures) varied considerably between years and topographic sites. Productivity was similar among the hilltop, south- and north-facing slopes, and was typical of semi-arid ecosystems (10-200 g(-2)). Productivity in the Wadi was consistently greater (up to 700 g(-2)) and reached the range of subhumid grassland ecosystems. 3. The effect of grazing exclusion on the composition of the annual vegetation was productivity-dependent. Lower similarity (Sorensen's quantitative similarity index) between grazed and ungrazed subplots was observed in the productive Wadi compared with the less productive sites. The small-scale variation in grazing impact on species composition, due to differences in productivity, is consistent with models predicting similar trends in perennial grasslands across larger scale

gradients. 4. The relationship between plant size (above-ground dry-weight), site productivity and response to fencing was analysed for the 36 most abundant annual species. Large species were more abundant in more productive sites, and small species at lower productivity, although few species were restricted to particular productivity levels. The response of individual species to protection from grazing was productivity dependent, with plant size playing a central role. Larger species tended to increase and small ones to decrease in abundance after fencing, with a mixed response in species with intermediate size. 5. A conceptual model is presented relating the response to protection from grazing along gradients of productivity to species plant size. This citation is from AGRICOLA.

1151. Site-specific responses of native and exotic species to disturbances in a mesic grassland community.

Hayes, Grey F. and Holl, Karen D.

Applied Vegetation Science 6(2): 235-244. (2003)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: clipping impact/ coastal prairie plant community/ disturbance dependent ecosystem/ grassland restoration/ grazing/ land management/ litter accumulation/ litter removal/ mesic grassland community disturbances/ mowing impact/ site specific responses/ soil disturbance/ vegetation composition

Abstract: Grassland communities are increasingly recognized as disturbance-dependent ecosystems, yet there are few replicated, multi-site studies documenting vegetation responses to varying frequencies and types of grassland disturbance. Even so, land managers frequently manipulate disturbance regimes in an attempt to favour native grassland plants over exotic species. We conducted a factorial experiment testing three frequencies of clipping combined with litter accumulation, litter removal, and soil disturbance within the highly threatened California coastal prairie plant community. We monitored the response of native/exotic, grass/forb plant guilds once a year for four years. More frequent clipping reduced cover of exotic grasses and favoured exotic forbs, whereas native species were largely unaffected by clipping frequency. Litter accumulation, litter removal, and soil disturbance did not affect vegetation composition. Effects of litter accumulation may take longer than our experiment allowed, and soil disturbance due to our treatments was not sufficiently strong to show consistent effects relative to mammalian soil disturbance. Treatment response of some plant guilds differed among sites, highlighting the importance of replicating experiments at several sites before recommending conservation management practices.

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1152. A six-year experimental restoration of biodiversity by shrub-clearing and grazing in calcareous grasslands of the French Prealps.

Barbaro, Luc; Dutoit, Thierry; and Cozic, Philippe

Biodiversity and Conservation 10(1): 119-135. (2001)

NAL Call #: QH75.A1B562; ISSN: 0960-3115

Descriptors: between year correspondence analysis: analytical method/ agri environmental schemes/ agro pastoral management/ calcareous grasslands: conservation, dry/ grazing/ low intensity farming systems/

plant communities: biodiversity/ shrub clearing/ six year permanent plant plot survey

Abstract: The conservation of dry calcareous grasslands in the French Prealps strongly depends on the maintenance of low-intensity farming systems supported by agri-environmental schemes. An experimental assessment of the effect of current agro-pastoral management on the biodiversity of plant communities was conducted during a six-year permanent plot survey in four sites with contrasting habitat conditions (mesic to xeric). Analyses of species changes showed: (i) a strong increase in species richness and open grassland species frequencies four years after shrub-clearing, and (ii) a noticeable recovery of rare annuals and perennial species of conservation interest establishing in gaps created by grazing. At the community level, the restoration effect was evaluated by a between-year Correspondence Analysis, explaining 10.9% of the total floristic variability versus 29.5% for the site effect (between-site CA). Species ordination by between-year CA showed similar trajectories of vegetation changes during restoration despite different habitat conditions and grazing regimes between sites. The successful restoration of prealpine calcareous grasslands was explained by the availability of seed sources during the study in adjacent grazed or mown grasslands. Thus, restoration assessment should focus on dispersal possibilities and functional roles of species rather than species richness only. Finally, the spatial (i.e. the area of patches that need to be restored) and temporal (i.e. the frequency of shrub-clearing) implications for the large-scale conservation of prealpine calcareous grasslands by current agro-pastoral management are discussed.

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1153. Size traits and site conditions determine changes in seed bank structure caused by grazing exclusion in semiarid annual plant communities.

Osem, Yagil; Perevolotsky, Avi; and Kigel, Jaime

Ecography 29(1): 11-20. (2006)

NAL Call #: QH540.H6; ISSN: 0906-7590

Descriptors: structural change/ resource availability/ grazing exclusion/ seed bank density/ site condition/ size trait/ semiarid plant community

Abstract: 1. Contrasting patterns of change in the seed bank of natural grasslands are frequently found in response to grazing by domestic herbivores. Here, we studied the hypotheses that a) patterns of change in seed bank density and composition in response to grazing depend on spatial variation in resource availability and productivity, and b) that variation among species in patterns of seed bank response to grazing is linked to differences in species size traits (i.e. size of plant, dispersal unit and seed). 2. Effects of sheep grazing exclusion on the seed bank were followed during five years in a semiarid Mediterranean annual plant community in Israel. Seed bank density and composition were measured in autumn, before the rainy season, inside and outside fenced exclosures in four neighboring topographic sites differing in vegetation characteristics, soil resources and primary productivity: Wadi (dry stream terraces, high productive site), Hilltop, South- and North-facing slopes (less productive sites). 3. Topographic sites differed in seed density (range ca 2500-18000 seed m⁻²) and in seed bank response to grazing exclusion. Fencing increased seed density by 78, 51 and 18% in the Wadi, South- and North-facing slopes, respectively, but had no

effect in the Hilltop. At the species level, grazing exclusion interacted with site conditions in determining species seed bank density, with larger or opposite changes in the high productive Wadi compared to the other less productive sites.4. Changes in seed bank structure after grazing exclusion were strongly related to species size traits. Grazing exclusion favored species with large size traits in all sites, while seed density of tiny species decreased strongly in the high productive Wadi. Species with medium and small size traits showed lesser or no responses.5. The size of plants, dispersal units and seeds were strongly correlated to each other, thus confounding the evaluation of the relative importance of each trait in the response of species to grazing and site conditions. We propose that the relative importance of plant size vs seed size in the response to grazing changes with productivity level.
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1154. Soil and vegetation responses to simulated trampling.

Abdel-Magid, A. H.; Trlica, M. J.; and Hart, R. H.
Journal of Range Management 40(4): 303-306. (1987)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1987/404/4abed.pdf>
Descriptors: livestock/ grazing/ prairie soils/ grasses/ soil water regimes/ soil compaction/ bulk density
This citation is from AGRICOLA.

1155. Soil seed bank and vegetation dynamics in Sahelian fallows; the impact of past cropping and current grazing treatments.

Herault, Bruno and Hiernaux, Pierre
Journal of Tropical Ecology 20(Part 6): 683-691. (2004)
NAL Call #: QH541.5.T7J68; ISSN: 0266-4674
Descriptors: canonical correspondence analysis: mathematical and computer techniques/ past crop management practice/ seasonal grazing regime/ soil seed bank/ vegetation dynamics
Abstract: The soil seed bank in a 5-y-old Sahelian fallow was studied through seed extraction and compared with germinations recorded either in controlled conditions, ex situ in a glasshouse, or in the field. The influence of phosphorus fertilizer and mulch application during the preceding crop period, and that of seasonal grazing regimes applied the last 2 y of fallowing, were assessed on the composition of the seed stock. *Ctenium elegans*, *Fimbristylis hispidula*, *Merremia pinnata* and *Phyllanthus pentandrus* accounted together for 75% of extracted seeds, 72% of ex situ, and 62% of in situ seedlings. Mulch treatment was correlated with the first axis of the canonical correspondence analyses performed on the seedling datasets. Mulch and phosphorus fertilizer treatments held similar responses, as they both favoured the seed bank of erect dicotyledons such as *P. pentandrus* and *Cassia mimosoides*. On the whole, the effects of grazing remained modest compared with the residual effects of past crop management practices. However, seedling densities increased as a result of dry-season grazing, while the soil seed bank decreased with wet-season grazing. Grazing also reduced the spatial heterogeneity of the seed bank rather than the overall number of species.
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1156. Soil seed banks on Argentine seminatural mountain grasslands after cessation of grazing.

Marco, Diane E. and Paez, Sergio A.
Mountain Research and Development 20(3): 254-261. (2000)
NAL Call #: GB500.M68; ISSN: 0276-4741
Descriptors: grazing cessation/ mountain grasslands/ seedling recruitment/ seminatural mountain grassland/ soil seed banks: abundance, composition, richness, species divergence/ vegetation
Abstract: We studied the seed bank and above-ground vegetation in a replicated field experiment with sites ungrazed for 22 years as well as three different grazed sites in seminatural grasslands in central Argentina. We examined the relationship between vegetation and seed bank composition, and tested 3 hypotheses predicting decrease in seed bank richness, decrease in seed bank abundance, and divergence of seed bank species composition from vegetation composition during succession. Grazing changed species abundance and the vertical structure of the vegetation but did not cause loss of species. Most of the taxa in the seed bank occurred in the vegetation. Seed bank richness, diversity, and abundance decreased significantly during grassland succession following cessation of grazing. Although in general the most abundant species in the vegetation at each site were also dominant in the respective seed bank, seed bank and vegetation composition differed greatly after cessation of grazing. The seed bank at sites undisturbed over the long term does not appear to be an important source of seedling recruitment after disturbance in these grasslands.
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1157. Some advantages of long-term grazing trials, with particular reference to changes in botanical composition.

Jones, R. M.; Jones, R. J.; and McDonald, C. K.
Australian Journal of Experimental Agriculture 35(7): 1029-1038. (1995)
NAL Call #: 23 Au792; ISSN: 0816-1089
Descriptors: pastures/ botanical composition/ nitrogen fertilizers/ stocking rate/ cattle/ range management/ grazing/ Queensland
This citation is from AGRICOLA.

1158. Some vegetation responses to selected livestock grazing strategies, Edwards Plateau, Texas.

Thurow, T. L.; Blackburn, W. H.; and Taylor, C. A.
Journal of Range Management 41(2): 108-114. (1988)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1988/412/4thur.pdf>
Descriptors: livestock/ rangelands/ grazing intensity/ plant ecology/ biomass/ ecological succession/ grazing/ Texas
This citation is from AGRICOLA.

1159. South Florida flatwoods range vegetation responses to season of deferment from grazing.

Kalmbacher, R. S.; Martin, F. G.; Pitman, W. D.; and Tanner, G. W.
Journal of Range Management 47(1): 43-47. (1994)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1994/471/9kalm.pdf>
Descriptors: *Aristida stricta*/ forage/ botanical composition/ seasonal variation/ burning/ grazing/ rangelands/ range management/ Florida

Abstract: Wiregrass (*Aristida stricta* Michx.)-dominated communities characterize extensive areas of South Florida that have been subjected to burning and uncontrolled grazing for decades. We evaluated the effects of deferment from grazing on species composition and herbage mass of these rangelands. Treatments were 1-ha enclosures that were closed to grazing December to March, closed April to July, closed August to November, always closed, or always open. All treatments were burned biennially. Herbage mass of preferred grasses was greater ($P < 0.05$) after 8 years in enclosures that were always closed (avg. 110 kg ha⁻¹) compared with other treatments, which were not different (avg. 65 kg ha⁻¹). Herbage mass of preferred grasses increased by 10 kg ha⁻¹ year⁻¹. Shrub biomass was greater in the treatment that was always closed (2,370 kg ha⁻¹) compared with other treatments (avg. 1,855 kg ha⁻¹), and biomass increased quadratically over years. There were no effects due to treatments or years on biomass of wiregrass, other less desirable grasses, grasslike species, or forbs. Frequency of occurrence of preferred grasses was not affected by treatment and averaged 41%. Although preferred grasses were relatively abundant, neither their biomass nor frequency of occurrence increased on a scale relevant to management for cattle production when protected from grazing. This biennially burned, seasonally flooded, infertile wiregrass range is not highly responsive to grazing or deferment from grazing, hence responses may not justify the inputs required for more intensive grazing management. This citation is from AGRICOLA.

1160. Southern forest range management.

Pearson, H. A. and Cutshall, J. R.
Annual Forestry Symposium 33: 36-52. (1984)
 NAL Call #: 99.9 L935; ISSN: 0076-1095
Descriptors: range management/ grazing/ cattle production/ forests/ Southeastern United States
 This citation is from AGRICOLA.

1161. Spatial components of plant-herbivore interactions in pastoral, ranching, and native ungulate ecosystems.

Coughenour, M. B.
Journal of Range Management 44(6): 530-542. (1991)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1991/446/1coug.pdf>
Descriptors: ungulates/ spatial distribution/ spatial variation/ grazing
Abstract: The spatial component of herbivory remains enigmatic although it is a central aspect of domestic and native ungulate ecosystems. The effects of ungulate movement on plants have not been clearly established in either range or wildlife management. While livestock movement systems have been implemented to cope with increases in livestock density, restrictions on movement, and overgrazing, a large number of studies have disputed the effectiveness of different livestock movement patterns. Traditional pastoralism, particularly nomadism, has been perceived as irrational and even destructive, but many studies have documented features of traditional pastoral land use that would promote sustainability. Disruptions of wild ungulate movements have been blamed for wildlife overgrazing and population declines, but actual patterns and mechanisms of disrupted movement and population responses have been poorly documented. Models that

integrate plant growth, ungulate movement, and foraging are suggested as a way to improve analyses of spatial plant-herbivore systems. Models must give due attention to nonforage constraints on herbivore distribution, such as topography. Models should assess the significance of movement as a means of coping with local climatic variation (patchy rainfall). Models that distribute an aggregate population over a landscape in relation to the distribution of habitat features deemphasize aspects of ungulate movements and population responses that inevitably cause nonideal distributions, particularly in natural ecosystems. Individual based models describe movement and foraging processes more accurately, but these models are difficult to apply over large areas. Both top-down and bottom-up approaches to spatial herbivory are needed. To model plant responses to movement, it is important to account for small scale phenomena such as tiller defoliation patterns, patch grazing, and grazing lawns as well as large scale patterns such as rotation and migration. Herbivory patterns at these different scales are interrelated.

This citation is from AGRICOLA.

1162. Species composition and above ground phytomass in chalk grassland with different management.

Willems, J. H.
Vegetatio 52(3): 171-180. (1983)
 NAL Call #: 450 V52; ISSN: 0042-3106
Descriptors: sheep/ grazing/ mowing/ abandonment/ light/ seedling establishment/ rare species/ species richness
Abstract: During the last decades chalk grasslands lost their agricultural importance in the greater part of their distribution area in Western Europe. Due to their botanical richness a number of chalk grassland sites were established as Nature Reserves. As a consequence of the semi-natural character of these grasslands, an appropriate management is necessary to maintain or recreate this vegetation, including a great number of rare and endangered species. This paper deals with the results of 3 different management practices, i.e., mowing in autumn, sheep grazing and abandoning, of a medium term (8-11 yr) permanent plot experiment. Sheep grazing was considered the best management since it resulted in the highest number of species (phanerogams as well as bryophytes), and the highest number of characteristic chalk grassland species. Abandoning resulted in a decrease in species number and a dominance of a few species only. The changes in species number are related to the above ground biomass. Under the canopy in the abandoned plot, light intensity and the Red/Far-red ratio are very low, which partly explains the decrease in species number as such conditions are not favorable to seedling emergence and survival.

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1163. Spring grazing by sheep effects on seasonal changes during early old field succession.

Gibson, C. W. D.; Dawkins, H. C.; Brown, V. K.; and Jepsen, M.
Vegetatio 70(1): 33-44. (1987)
 NAL Call #: 450 V52; ISSN: 0042-3106
Descriptors: plant composition/ abundance/ secondary succession/ conservation

Abstract: This paper describes early secondary succession on an old field on limestone released from cultivation four years previously. Seasonal changes in plant composition after spring grazing by sheep are compared with those in ungrazed controls. Grazed and ungrazed paddocks were laid out in Latin squares. Plants were sampled before and several times after grazing in April, at several spatial scales. Major changes in plant abundance and sward characters such as height and density persisted throughout the growing season. Annual herbs increased after grazing, but annual grasses declined, as did short-lived perennial herbs. Effects on perennial herbs were weak; perennial grasses usually increased but this depended on the species. This pattern confirms that sheep grazing affects the direction, as well as the rate of succession. Some effects, such as increases in biennial herbs and in species richness, were only evident at large scales of sampling, suggesting that they arose from changes in rare and widely dispersed species. Other species were affected at different spatial scales, and no one sampling method detected the full range of effects. These results indicate the potential power of manipulating grazing early in secondary succession for directing the course of community change, for conservation or other purposes.

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1164. A state-transition approach to understanding nonequilibrium plant community dynamics in Californian grasslands.

Jackson, Randall D. and Bartolome, James W.

Plant Ecology 162(1): 49-65. (2002)

NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: classification and regression tree analysis: mathematical and computer techniques/ non equilibrium state transition model: mathematical and computer techniques/ two way indicator species analysis: twinspan, applied and field techniques/ climate/ coast range grassland: California annual grassland subtype/ coastal prairie/ dataset: spatially replicated, temporally replicated/ grasslands/ grazing intensity/ grazing management prescriptions/ nonequilibrium plant community dynamics/ residual dry matter treatment levels/ state transition approach/ system productivity/ valley grassland/ vegetation transitions: twinspan created

Abstract: Using a spatially and temporally replicated dataset, we built a state-transition model for Californian grasslands. We delineated vegetation states by allowing TWINSpan to classify plot-level (approx 10 m²) species cover data collected over 3 to 5 consecutive years on 9 sites in an experimental design that incorporated 5 residual dry matter (RDM) treatment levels representative of the range of grazing management prescriptions for this type (0, 280, 560, 841, 1121 kg RDM/ha). We identified and described a new California annual grassland subtype-Coast Range Grassland - that is distinct from the previously described Coastal Prairie and Valley Grassland. Classification and regression tree (CART) analysis correctly classified 63% of TWINSpan-created vegetation transitions among states with interactions among site and monthly climate averages as the main driving factors. The RDM variable (a surrogate for grazing intensity) was important in model refinement, but only at a few site X year combinations and predictions were rarely attributable to the grazing intensity gradient. The equilibrium-based conclusion that grazing intensity manipulation creates

distinctive community structure was restricted in application to a few sites. The results suggest that equilibrium models may be appropriate for predicting system productivity but not the community composition, details of which require a nonequilibrium approach. The non-equilibrium state-transition model offers considerable potential for improving the development and testing of hypotheses about vegetation change and the limitations of management controls, but will require relatively large spatially and temporally replicated datasets.

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1165. Steer and vegetation response to short duration and continuous grazing.

Pitts, J. S. and Bryant, F. C.

Journal of Range Management 40(5): 386-389. (1987)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/405/1pitt.pdf>

Descriptors: steers/ rangelands/ grazing/ stocking rate/ liveweight gain/ feeding preferences/ botanical composition/ forage/ Texas

This citation is from AGRICOLA.

1166. Stocking rate and grazing frequency effects on Nebraska sandhills meadows.

Volesky, J. D.; Schacht, W. H.; and Richardson, D. M.

Journal of Range Management 57(5): 553-560. (Sept. 2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: rotational grazing/ botanical composition/ forage quality/ *Elymus trachycaulus*/ *Carex*/ defoliation/ biomass/ tillers/ Nebraska

Abstract: Nearly one-half million ha of the Nebraska Sandhills is comprised of highly productive wet meadows. A study was conducted from 1998 to 2001 to evaluate the effects of stocking rate and grazing frequency on herbage dynamics, disappearance, and composition of a wet meadow dominated by cool-season vegetation. Defoliation characteristics were measured on 2 key species. Stocking rates were 148, 296, and 444 AUD ha⁻¹ combined with a grazing frequency of 3 (F3) or 5 (F5) times. Cumulative standing crop disappearance and height reduction increased linearly with increasing stocking rate. Disappearance was 1,920, 2,700, and 3,090 kg ha⁻¹ for the 148, 296, and 444 AUD ha⁻¹ stocking rates, respectively. Greater disappearance at the highest stocking rate was expected based on calculated intake estimates for that stocking rate. Percentage of tillers grazed and percentage height reduction increased with stocking rate for both key species. Percentage of tillers grazed was greater under F3 compared to F5. This likely was caused by higher grazing pressures under the F3 treatment at each grazing period. Frequency of occurrence of the primary plant species or groups was not affected by stocking rate or grazing frequency during any year of the study (P > 0.05); however, frequency of occurrence of legumes and Kentucky bluegrass (*Poa pratensis* L.) was higher in grazed pastures compared to the control. The abundance of soil moisture in these meadows appeared to mitigate the effects of heavier defoliation associated with higher stocking rates. However, defoliation of the taller grasses and sedges resulted in a more open canopy allowing shorter-statured species to increase. Overall, stocking rate affected more response

variables than grazing frequency and the productivity of our wet meadow site would potentially support a stocking rate of 296 AUD ha⁻¹.

This citation is from AGRICOLA.

1167. Stream channel and vegetation responses to late spring cattle grazing.

Clary, W. P.

Journal of Range Management 52(3): 218-227. (1999)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1999/523/218-227_clary.pdf

Descriptors: cattle/ grazing intensity/ streams/ botanical composition/ grasses/ forbs/ shrubs/ canopy/ Salix/ stream erosion/ riparian buffers/ plant litter/ Idaho

Abstract: A 10-year riparian grazing study was conducted on a cold, mountain meadow riparian system in central Idaho in response to cattle grazing-salmonid fisheries conflicts. Six pastures were established along Stanley Creek to study the effects on riparian habitat of no grazing, light grazing (20-25% utilization), and medium grazing (35-50%) during late June. Stream channels narrowed, stream width-depth ratios were reduced, and channel bottom embeddedness decreased under all 3 grazing treatments as the area responded to changes from heavier historic grazing use. Streambank stability increased and streamside willow communities (*Salix* spp. L.) increased in both height and cover under all 3 treatments. Plant species richness increased on both streamside and dry meadow areas during the years of grazing and moderate drought. The numbers of species receded to near original levels in the ungrazed and light grazed pastures in 1996, a wet post-grazing year, primarily due to a decrease in forb species. Streamside graminoid height growth was similar among treatments after 1 year of rest. Most measurements of streamside variables moved closer to those beneficial for salmonid fisheries when pastures were grazed to 10 cm of graminoid stubble height; virtually all measurements improved when pastures were grazed to 14 cm stubble height, or when pastures were not grazed. Many improvements were similar under all 3 treatments indicating these riparian habitats are compatible with light to medium late spring use by cattle.

This citation is from AGRICOLA.

1168. Streambank and vegetation response to simulated cattle grazing.

Clary, W. P. and Kinney, J. W.

Wetlands 22(1): 139-148. (2002)

NAL Call #: QH75.A1W47; ISSN: 0277-5212

Descriptors: stream banks/ cattle/ grazing/ environmental effects/ vegetation effects/ riparian vegetation/ plant growth/ bank erosion/ channel morphology/ experimental data/ streams/ riparian environments/ plants/ livestock/ vegetation/ simulation/ environmental impact/ wetlands/ feeding behaviour/ river banks/ USA, Idaho/ grazing

Abstract: Simulated grazing techniques were used to investigate livestock impacts on structural and vegetation characteristics of streambanks in central Idaho, USA. The treatments, continued over two years, consisted of no grazing, simulated moderate early summer grazing, simulated moderate mid-summer grazing, and simulated heavy season-long grazing. The moderate treatments depressed the streambank surface about 3 cm, while the heavy season-long treatment resulted in an 11.5-cm

depression. There were no differences between the no-grazing and moderate-grazing treatments for change in stream width, bank angle, bank retreat, or root biomass. The heavy season-long treatment, however, produced significant changes in these variables. The amount of foliage biomass (i.e., kg ha super(-1)) removed by treatment was similar between the two years of study for the moderate treatments. The foliage removed from the heavy season-long treatment plots greatly decreased in the second year as plant growth decreased. Ten months after the last treatment application, the average spring foliage growth was 20-43% lower on the moderate treatment plots and 51-87% lower on the heavy season-long treatment plots than on the untreated control plots.

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1169. Structural resilience of a willow riparian community to changes in grazing practices.

Knopf, F. L. and Cannon, R. W.

In: Proceedings of the Wildlife-Livestock Relationships Symposium. (Held 20 Apr 1981-22 Apr 1981 at Coeur D'alene, Idaho.) Peek, James M. and Dalke, P. D. (eds.) Moscow, Idaho: Forest, Wildlife & Range Experiment Station, University of Idaho; pp. 198-207; 1982.

NAL Call #: SF84.84.W5 1981

1170. Studies in the grazing of a drained lowland fen in Iceland: The responses of the vegetation to livestock grazing.

Magnusson, B. and Magnusson, S. H.

Buvisindi 4: 87-108. (1990)

NAL Call #: S11.184; ISSN: 1012-6910

Descriptors: Carex nigra/ Carex panicea/ Agrostis capillaris/ Eriophorum angustifolium/ Pinguicula vulgaris/ Polytrichum swartzii/ Racomitrium ericoides/ Cladonia chlorophaea/ sheep/ horse/ calf/ moisture/ nutrient regime/ population decline management/ species abundance/ seasonality/ detrended correspondence analysis/ canonical correlation analysis

Abstract: The effects of livestock grazing on vegetation of a drained lowland fen dominated by *Carex nigra* and *Agrostis capillaris* were studied at a site in southern Iceland, which had been used for thirteen years in grazing experiments, initially with sheep and calves, but more recently with horses only. The study was carried out in three sections which were grazed during the summer at low (L), moderate (M) and intense (I) stocking rates. Within twenty plots floristic composition, species abundance and extent of bare ground were recorded, depth to water table determined and samples of soil and water obtained. The vegetation data was analyzed with the procedure detrended correspondence analysis (DCA) and the relationships between the DCA vegetation pattern and environmental and grazing variation were investigated with the aid of canonical correlation analysis (CCA). The DCA revealed strong trends of plant community change which were related to variation in moisture-nutrient regime and grazing intensity. The vegetation responded weakly to difference in grazing intensity between the L and M sections, but markedly between them and the I section. In the I section ground had become bare of vegetation, species richness increased, preferentially grazed species, e.g. *Carex nigra* and *Agrostis capillaris* declined in abundance, while more grazing tolerant and species of disturbed and strongly minerotrophic habitats, e.g. *Carex panicea*, *Eriophorum*

angustifolium, Pinguicula vulgaris, Polytrichum swartzii, Racomitrium ericoides and Cladonia chlorophaea had increased in abundance. The results of the study are discussed in relation to the grazing history at the site and their implications for grazing management.
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1171. The success of a rotational grazing system in conserving the diversity of chalk grassland Auchenorrhyncha.

Morris, M. G.; Clarke, R. T.; and Rispin, W. E.
Journal of Insect Conservation 9(4): 363-374. (2005)
NAL Call #: QL362.J68; ISSN: 1366-638X
Descriptors: rotational grazing system: applied and field techniques/ conservation/ species diversity/ chalk grassland
Abstract: A complex rotational grazing trial on a south-facing slope of chalk grassland at the Old Winchester Hill National Nature Reserve is briefly introduced. The responses of 23 numerous species of Auchenorrhyncha, and of species richness (S) and total abundance (N), from 1981 to 1985 are described. The greatest effects were those of variation between years, between positions on the hillside (top, middle and bottom) and between grazing plots within these positions. 10 (of the total of 23) species favoured the top of the slope, where the vegetation was significantly taller than in the middle or at the bottom. S, N and the numbers of 8 species were significantly lower on plots grazed in the year of sampling compared with ungrazed plots. Early (vs. late) grazing significantly reduced S, N and the abundance of two species, but increased the numbers of *Macrosteles laevis*. S, N and the abundance of 13 species was significantly and positively correlated with vegetation height measured early (May-June) and late (July-October); the numbers of 4 other species were so correlated with the latter height only. The significance of the results is discussed in relation to the management of grassland nature reserves for the maintenance of high invertebrate diversity. It is concluded that rotational management is an important and valuable system, but suggested that such systems should be as simple as possible whilst remaining adequate to achieve conservation objectives.
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1172. Succession and livestock grazing in a northeastern Oregon riparian ecosystem.

Green, D. M. and Kauffman, J. B.
Journal of Range Management 48(4): 307-313. (1995)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1995/484/307-313_green.pdf
Descriptors: species diversity/ ecological succession/ introduced species/ riparian buffers/ grazing/ plant litter/ Oregon
Abstract: Comparisons of vegetation dynamics of riparian plant communities under livestock use and exclusions over a 10 year period were quantified in a Northeastern Oregon riparian zone. We measured species frequency, richness, diversity, evenness, and livestock utilization in 8 plant communities. Livestock grazed the study area from late August until mid September at a rate of 1.3 to 1.8 ha/AUM. Utilization varied from > 70% in dry meadows to < 3% in cheatgrass dominated stands. Ungrazed dry and moist meadow communities had significantly lower ($P < 0.1$) species richness and diversity when compared to grazed

counterparts. In the most heavily grazed communities, ruderal and competitive ruderal species were favored by grazing disturbance. In enclosures of the same communities, competitive or competitive stress tolerant species were favored. Both height and density of woody riparian species were significantly greater in ungrazed gravel bar communities. Our results indicate that influences of herbivory on species diversity and evenness varies from 1 community to another and basing management recommendation on 1 component ignores the inherent complexity of riparian ecosystems.
This citation is from AGRICOLA.

1173. Survey of livestock influences on stream and riparian ecosystems in the western United States.

Belsky, A. J.; Matzke, A.; and Uselman, S.
Journal of Soil and Water Conservation 54(1): 419-431. (1999)
NAL Call #: 56.8 J822; ISSN: 0022-4561
<http://www.onda.org/library/papers/BelskyGrazing.pdf>
Descriptors: livestock/ water quality/ riparian land/ streams/ grazing/ environmental effects/ channel morphology/ arid lands/ riparian environments/ arid environments/ agricultural pollution/ agricultural runoff/ pollution effects/ environmental impact/ water pollution/ river banks/ livestock (see also individual animals)/ water quality (natural waters)/ streams (in natural channels)/ ecology/ pollution (environmental)/ arid regions/ USA, west/ livestock grazing/ USA, western
Abstract: This paper summarizes the major effects of livestock grazing on stream and riparian ecosystems in the arid West. The study focused primarily on results from peer-reviewed, experimental studies, and secondarily on comparative studies of grazed versus naturally or historically protected areas. Results were summarized in tabular form. Livestock grazing was found to negatively affect water quality and seasonal quantity, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation, and aquatic and riparian wildlife. No positive environmental impacts were found. Livestock also were found to cause negative impacts at the landscape and regional levels. Although it is sometimes difficult to draw generalizations from the many studies, due in part to differences in methodology and environmental variability among study sites, most recent scientific studies document that livestock grazing continues to be detrimental to stream and riparian ecosystems in the West.
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1174. Survival of juvenile basin big sagebrush under different grazing regimes.

Owens, M. K. and Norton, B. E.
Journal of Range Management 43(2): 132-135. (1990)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/432/10owen.pdf>
Descriptors: *Artemisia tridentata*/ mortality/ pastures/ grazing intensity/ plant density/ grazing/ *Agropyron desertorum*/ population dynamics/ Utah
Abstract: Basin big sagebrush (*Artemisia tridentata* Nutt ssp *tridentata* Beetle) often invades rangelands seeded to introduced grass species. Livestock grazing may enhance the invasion but the effects of grazing intensity on invasion rates are not known. To investigate invasion rates, individual big sagebrush plants were marked and observed for mortality over a 4-year period within a short duration

grazing (SDG) cell and continuous season-long grazed pastures. Over the course of the experiment, the survival of juvenile big sagebrush was higher in the SDG cell.

However, there were no differences in survival between grazing treatments during the first year of the study. In subsequent years, declining tiller numbers and density of individual crested wheatgrass plants may have decreased the competitive pressure on juvenile big sagebrush under SDG. The intensity of grazing did not affect which individual juveniles survived. Plants with more than 50 cm² canopy area had the highest survival rates of all big sagebrush in both grazing treatments. Plant density, which ranged from 1 to 30 plants m⁻², did not affect plant survival in either of the grazing treatments. Big sagebrush survival in the SDG cell was higher in a rhizomatous grass community than in a tussock grass community.

This citation is from AGRICOLA.

1175. Survival of perennial grass seedlings under intensive grazing in semi-arid rangelands.

Salihi, D. O. and Norton, B. E.

Journal of Applied Ecology 24(1): 145-152. (1987)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: Agropyron desertorum/ cattle/ germination/ trampling/ agriculture/ Utah/ USA

Abstract: (1) The hypothesis that intensive grazing practices such as short-duration grazing, benefit seedling survival through hoof action of the trampling animals was tested in a one-year study [Utah]. Estimation of survival rates and hypothesis testing followed the numerical optimization approach to maximum likelihood analysis. (2) A total of 1598 crested wheatgrass seedlings (*Agropyron desertorum* (Fisch. ex Link) Schult.), of which 52.5% were protected from livestock grazing, were involved in the study. Seedling survival did not differ significantly between grazed and ungrazed populations prior to the first grazing treatment. (3) Grazing reduced seedling survival significantly in the first as well as in a second three-day grazing period. The treatment effect was not pronounced in the second grazing period. (4) Ten months after cattle were removed from the pastures the two 3-day grazing treatments continued to influence survival of seedlings. Of the 759 seedlings recorded in grazed plots only three survived 1 year after their emergence. In contrast, ninety-seven seedlings survived 1 year in the protected plots where 839 seedlings germinated. (5) Crested wheatgrass seedling survival in relation to the proximity of their well-established parent plants, was also investigated. The majority of seedlings (56%) emerged in bare soil more than 10 cm away from established grasses. Survival was more related to grazing treatment than to seedling location.

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1176. Sustainability and range management in the Patagonian steppes.

Golluscio, Rodolfo A.; Deregibus, V. Alejandro; and Paruelo, Jose M.

Ecologia Austral 8(2): 265-284. (1998); ISSN: 0327-5477

Descriptors: grazing management/ range management/ resource sustainability

Abstract: One hundred years of grazing by domestic herbivores hampered the ecological sustainability of the Patagonian steppes. We propose three management-related factors of such ecosystem degradation: (1) overestimation of carrying capacity of the rangelands, (2)

inadequate distribution of animals in very large, heterogeneous paddocks, and (3) year-long continuous grazing. We suggest that these three management factors interact with the highly selective grazing habit of sheep generating a pattern of grazing heterogeneity at three scales: landscape, community, and population. Grazing differs in intensity among areas of the same paddock, among plant species, and even among individuals of the same species. As a consequence, the most palatable species within a patch are almost continuously subjected to a very high frequency of defoliation in the most preferred areas, which increases the mortality of the most preferred individuals of these forage species. We review the available ecological knowledge and range management technologies that may contribute to revert degradation. A quick assessment of both the availability and spatial heterogeneity of forage resources is now possible with the aid of remote sensing. Range assessment will allow to estimate the carrying capacity of each paddock, and separate different vegetation units. From information on the phenology of the different vegetation units it is possible to decide the timing of grazing and/or resting periods of single paddocks. Rotational grazing methods allow for a recovery of the most preferred species and for a reduction of the heterogeneity of defoliation at the three mentioned levels. Research efforts are needed to develop warning systems, improve the productivity and use efficiency of meadows, and design and evaluate grazing methods for the most arid areas of the region.

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1177. Tallgrass prairie response to grazing system and stocking rate.

Gillen, R. L.; McCollum, F. T.; Tate, K. W.; and Hodges, M. E.

Journal of Range Management 51(2): 139-146. (1998)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/1998/512/139-146_gillen.pdf

Descriptors: continuous grazing/ plant succession/ stocking rate/ grazing/ grazing systems/ rotational grazing/ botanical composition/ grasslands/ prairies

Abstract: Grazing system and stocking rate effects on standing crop of species and relative species composition of tallgrass prairies in north-central Oklahoma were evaluated from 1989 to 1993. Twelve experimental units, consisting of pastures dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*) and indiangrass (*Sorghastrum nutans*), were managed in a short duration rotation or continuous grazing system with stocking rates ranging from 51.5 animal-unit-days/ha (AUD/ha) to 89.8 AUD/ha. Yearling steers grazed the pastures from late April to late September. Cumulative precipitation was above average during the study period. Continuous and rotational grazing affected the major herbage components similarly over time. Standing crop of all major herbage components declined as stocking rate increased. The standing crop of the major herbage components also declined from the first to the last year of the study. The decrease in standing crop of big bluestem, indiangrass and forbs over years was greatest at lighter stocking rates. Relative composition of switchgrass (*Panicum virgatum*) increased at the lower stocking rates over time in both grazing systems. The relationship between shortgrasses and stocking rate was different

between grazing systems at the start of the study but became similar between grazing systems over time. After 5 years, shortgrasses were positively related to stocking rate under both grazing systems. It is suggested that favourable growing conditions and the high seral state of the vegetation in the experimental pastures may have tempered the response to grazing treatments.
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1178. Technical note: Vegetation response to increasing stocking rate under rotational stocking.

Taylor, C. A.; Ralps, M. H.; and Kothmann, M. M.
Journal of Range Management 50(4): 439-442. (1997)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1997/504/439-443_taylor.pdf

Descriptors: botanical composition/ grazing management/ livestock grazing/ native range/ rotational grazing
Abstract: This 10-year study was designed to evaluate vegetation response to increasing stocking rates under rotational stocking (3 days graze, 51 days rest) and long-term rest. The 4 stocking rate treatments ranged from the recommended rate for moderate continuous grazing to 2.7 times the recommended rate. Common curly-mesquite [*Hilaria belangeri* (Steud.) Nash] increased ($P = 0.05$) in all grazed treatments and decreased in the livestock enclosure. Sideouts grama [*Bouteloua curtipendula* (Michx.) Torr.] along with other midgrasses decreased ($P = 0.07$) in all grazed treatments and increased in the livestock enclosure. Because the midgrasses were palatable species and not abundant, they were defoliated too intensively and too frequently. Rotational stocking was not able to sustain initial species composition at any of the stocking rates tested.

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1179. Temporal responses over 30 years to removal of grazing from a mid-altitude snow tussock grassland reserve, Lammerlaw Ecological Region, New Zealand.

Mark, Alan F. and Dickinson, Katharine J. M.
New Zealand Journal of Botany 41(4): 655-668. (2003)
NAL Call #: 450 N48; ISSN: 0028-825X
Descriptors: conservation management/ fire/ floristics/ grazing removal/ herbivory/ human impact/ mid altitude snow tussock grassland reserve/ native grassland/ pollen record/ succession/ temporal response

Abstract: Monitoring of five representative sites in the 144-ha Black Rock Scientific Reserve of mid-altitude (690-770 m) narrow-leaved snow tussock (*Chionochloa rigida*) grassland over the 30 years since its establishment has revealed, contrary to an early prediction, significant increases in both cover and height of snow tussock. By contrast, co-dominant shrubs have shown only a slight, generally non-significant gain, with *Dracophyllum longifolium* rather than the predicted *Hebe odora* as the only significant increaser. Several sub-dominant shrubs (*Coprosma cheesemaniae*, *Leucopogon colensoi*, *Gaultheria macrostigma*) plus some mosses (*Hypnum cupressiforme*) and lichens (*Cladia retipora*, *Stereocaulon ramulosum*) have increased significantly while some rosette herbs (*Brachyglottis bellidioides*, *Oreomyrrhis colensoi*, *Plantago novae-zelandiae*, and the adventive *Hypochoeris radicata*) have declined. The generally aggressive exotic flatweed *Hieracium pilosella* remains as yet a minor component. These changes in subcanopy cover probably reflect the

obvious increase in shade and dampness of the micro-habitat. The height-frequency sampling indicates an overall decline in vascular species diversity since losses have significantly exceeded gains over the 30-year period of monitoring. Our results confirm that low- to mid-altitude snow tussock grassland ecosystems can be sustained for at least several decades, for their conservation, landscape, and water yield values. We question the interpretation of a general lack of tussock grassland below treeline in immediate pre-human times, and its widespread downslope replacement of forest following Polynesian fires, since it is at variance with the known ecology of the dominant grass species, evidence from relevant pollen records, and results from the present study. Rather, we interpret the available evidence as indicative of succession to a vegetation mosaic of non-woody and woody dominants related to physiography and disturbance, as currently being debated for north-western Europe. We hypothesise that such a mosaic would more closely reflect the pre-human situation below treeline which would have been moulded by periodic fire and avian and invertebrate herbivory, in the absence of land mammals.

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1180. Tiller defoliation in a moderate and heavy grazing regime.

Briske, D. D. and Stuth, J. W.
Journal of Range Management 35(4): 511-514. (1982)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1982/354/26bris.pdf>
This citation is from AGRICOLA.

1181. Timescale of perennial grass recovery in desertified arid grasslands following livestock removal.

Valone, Thomas J.; Meyer, Marc; Brown, James H.; and Chew, Robert M.
Conservation Biology 16(4): 995-1002. (2002)
NAL Call #: QH75.A1C5; ISSN: 0888-8892
Descriptors: desertified arid grasslands/ land management/ livestock grazing removal/ recovery timescale/ shrublands/ vegetation stability
Abstract: Over the past two centuries, perennial grass cover has declined and shrub density has increased in many arid grasslands. These changes in vegetation, characteristic of desertification, are thought to have occurred often following prolonged periods of intense grazing by domestic livestock. At many such sites, however, the subsequent removal of livestock grazing for up to 20 years has not resulted in increased grass cover. The apparent stability of vegetation following the cessation of livestock grazing has led to the hypothesis that desertified arid grasslands exist in alternate stable states of either grassland or shrubland over timescales relevant to management. To better understand the timescale of grass recovery in historic arid grasslands dominated by shrubs, we examined the vegetation at two nearby desertified sites that differed in the length of time since livestock removal. There was little difference between the site ungrazed for 20 years and the shrub-dominated vegetation on the other side of the exclusion fence. At a site ungrazed for 39 years there was significantly higher perennial grass cover inside the exclusion fence than outside, and nearly all the increase had occurred over the past 20 years. These data suggest

that there may be time lags of 20 years or more in the response of perennial grasses to removal of livestock in historic grassland ecosystems dominated by shrubs.

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1182. Ungulate herbivory on Utah aspen: Assessment of longterm exclosures.

Kay, C. E. and Bartos, D. L.

Journal of Range Management 53(2): 145-153. (2000)

NAL Call #: 60.18 J82; ISSN: 0022-409X

http://jrm.library.arizona.edu/data/2000/532/145-153_kay.pdf

Descriptors: livestock/ grazing/ browsing/ grazing/ population dynamics/ wildlife/ natural regeneration/ understory

Abstract: The role of livestock grazing and big-game browsing in the decline of aspen (*Populus tremuloides*) in the Intermountain West has long been questioned. All known aspen exclosures (n=8) on the Dixie and Fishlake National Forests in south-central Utah were measured during late summer of 1995 and 1996 to determine aspen stem dynamics, successional status, and understory species composition. Five of the exclosures were of a 3-part design with a total-exclusion portion, a livestock-exclusion portion, and a combined-use portion which permitted the effects of deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) herbivory to be measured separately from those of livestock. Aspen within all total-exclusion plots successfully regenerated and developed multi-aged stems without the influence of fire or other disturbance. Aspen subjected to browsing by wildlife, primarily mule deer, either failed to regenerate successfully or regenerated at stem densities significantly lower (2498 stems ha⁻¹) than that on total-exclusion plots (4474 stems ha⁻¹). On combined wildlife-livestock-use plots, most aspen failed to regenerate successfully, or did so at low stem densities (1012 stems ha⁻¹). Aspen successfully regenerated on ungulate-use plots only when deer numbers were low. Similarly, ungulate herbivory had significant effects on understory species composition. In general, utilization by deer tended to reduce shrubs and tall palatable forbs while favoring the growth of native grasses. The addition of livestock grazing, however, tended to reduce native grasses while promoting introduced species and bare soil. Thus, communities dominated by old-age or single-age trees appear to be a product of ungulate browsing, not a biological attribute of aspen as has been commonly assumed. There was no evidence that climatic variation affected aspen regeneration. Observed differences are attributed to varied histories of ungulate herbivory.

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1183. Use of a model to analyse the effects of continuous grazing managements on seasonal patterns of grass production.

Johnson, I. R. and Parsons, A. J.

Grass and Forage Science 40(4): 449-458. (1985)

NAL Call #: 60.19 B773; ISSN: 0142-5242

Descriptors: range management/ grazing intensity/ crop production/ seasonal variation/ mathematical models

This citation is from AGRICOLA.

1184. Use of sheep grazing in the restoration of semi-natural meadows in northern Finland.

Hellstrom, Kalle; Huhta, Ari Pekka; Rautio, Pasi; Tuomi, Juha; Oksanen, Jari; and Laine, Kari

Applied Vegetation Science 6(1): 45-52. (2003)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: grazing management: applied and field techniques/ semi natural meadows: restoration/ soil fertility

Abstract: The biodiversity of species-rich semi-natural meadows is declining across Europe due to ceased management. In this study we aimed to find out how successfully the local species richness of an overgrown semi-natural mesic meadow could be restored by sheep grazing after a long period of abandonment. The cover of vascular plant species in grazed plots and ungrazed exclosures was studied for five years and the responses of different functional plant groups were followed (herbs vs grasses, tall vs short species, species differing in flowering time, species representing different Grime's CSR strategies and species indicative of rich vs poor soil). Grazing increased species number by nearly 30%. On grazed plots the litter cover practically disappeared, favouring small herbs such as *Rhinanthus minor*, *Ranunculus acris*, *Trifolium pratense* and the grass *Agrostis capillaris*. Grazing decreased the cover of the late flowering tall herb *Epilobium angustifolium* but had no effect on the abundance of the early flowering tall herbs *Anthriscus sylvestris* or *Geranium sylvaticum*. We suggest that to succeed in restoration it is useful to determine the responses of different functional plant groups to grazing. Grassland managers need this information to optimize the methods and timing of management used in restoration. Additional management practices, such as mowing, may be needed in mesic meadows to decrease the dominance of tall species. The availability of propagules seemed to restrict further increase of species richness in our study area.

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1185. The use of sheep grazing to recreate species-rich grassland from abandoned arable land.

Gibson, C. W. D.; Watt, T. A.; and Brown, V. K.

Biological Conservation 42(3): 165-184. (1987)

NAL Call #: S900.B5; ISSN: 0006-3207

Descriptors: plant growth/ ecology/ conservation/ vegetation succession/ species diversity/ species abundance/ species composition/ seasonal variation

Abstract: This paper reports the first two years' results of an investigation into the use of sheep grazing to restore species-rich calcicolous grasslands. Five different sheep-grazing treatments were applied to separate parts of a 10 ha arable field last cultivated in 1981. The field has shallow soils over Jurassic corallian limestone. Three treatments were applied in a replicated experimental design. These were ungrazed controls, a short period of grazing in spring and a similar short period in autumn. The other two treatments, more realistic for conservation management, were impractical for a formal design: one area was grazed continuously from April to November with a short break during the summer; the other was grazed continuously from August to early November. Grazing treatments were started in 1985. By the end of 1986, 43 of the 75 vascular plant species restricted to patches of old calcicolous grassland within 2 km of the site had colonised the field. Most of these species could have spread from adjacent patches of old

grassland, but six came from further away. Grazing treatment did not affect the chance of species arriving, but their establishment was better in the grazed areas. Colonisation proceeded downhill, against the prevailing wind. Species richness, diversity, and the abundance of individual plant species in the sward were increased by grazing treatments. In general, the effects of 'realistic' grazing treatments were predictable from the effects of simpler treatments in the formally designed experimental area. By the end of 1986, the area grazed in both spring and autumn had reached a state similar to the ex-arable chalk grasslands described by Cornish (1954). Although the species composition was not yet comparable to a mature calcicolous grassland, many of the component species had already arrived (including one national rarity) and were increasing, in contrast to the control areas.

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1186. Vegetal change in the absence of livestock grazing, mountain brush zone, Utah.

Austin, D. D.; Urness, P. J.; and Riggs, R. A. *Journal of Range Management* 39(6): 514-517. (1986) NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/396/9aust.pdf>

Descriptors: gambel oak/ ecology/ conservation
Abstract: Canopy cover of vegetation dominated by Gambel oak was determined in 1983 in adjacent canyons characterized by different grazing histories. Results were compared with data collected in 1935, and the methods replicated those used in the earlier study. Vegetal changes since 1935 in Red Butte Canyon where livestock grazing had been excluded since 1905 were small compared with those of Emigration Canyon where heavy grazing continued into the 1930's, but was gradually phased out and discontinued in 1957. Large differences in vegetal cover between the 2 canyons reported in 1935 were mostly eliminated by 1983.

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1187. Vegetation and arthropod communities at Bou Hedma National Park, southern Tunisia, under different grazing regimes.

Moldrzyk, Uwe

Kaupia Darmstaedter Beitrage zur Naturgeschichte 12: 151-166. (2003); ISSN: 0941-8482

Descriptors: nutrition/ diet/ ecology/ land zones/ Palaearctic Region/ Africa/ Arthropoda: community structure/ national park/ Tunisia/ Bou Hedma National Park/ mammalian grazing regimes comparison/ Mammalia/ arthropods/ chordates/ invertebrates/ mammals/ vertebrates

Abstract: From April 1995 to July 1996, flora and arthropod fauna of three different areas of Bou Hedma National Park in southern Tunisia have been investigated: a) inside the park without any grazing by large herbivores; b) inside the park with grazing by antelopes, gazelles and ostriches; c) outside the park with grazing by sheep and goats. The vegetation was studied by the method of Braun-Blanquet and the determination of phytomass. Arthropods were captured with pitfall traps and diversity and similarity indices were calculated. After sufficient precipitation, the ungrazed area inside the national park differed considerably from the two grazed areas regarding the epigeic arthropod fauna. Due to rainfall during winter months, the vegetation period of most therophytes takes place at this time. By reducing

competition from perennial plants, grazing stimulates growth of annuals, improving conditions for many arthropods. During draught, the comparison of arthropods collected revealed significant differences between the areas within and outside the park. At this time, intensive grazing by numerous domestic animals had negative consequences on the vegetation, which was weakened by the deficient water balance. Caused by the poor soil coverage, Isopoda, Microcoryphia and Isoptera in particular were less frequent outside the park. Remarkably, grazing by wild bovids improved phytomass and the condition of perennial plants.

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1188. Vegetation and litter changes of a Nebraska Sandhills prairie protected from grazing.

Potvin, M. A. and Harrison, A. T.

Journal of Range Management 37(1): 55-58. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/371/13potv.pdf>

Descriptors: Nebraska

This citation is from AGRICOLA.

1189. Vegetation and soil responses to cattle grazing systems in the Texas Rolling Plains.

Wood, M. K. and Blackburn, W. H.

Journal of Range Management 37(4): 303-308. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/374/4wood.pdf>

Descriptors: shortgrass/ midgrass/ shrub/ zonal community/ cattle/ enclosure/ stocking rate/ productivity
Abstract: The influence of cattle grazing on selected vegetation and soil parameters was evaluated on a clay flat range site with shrub zonal, midgrass, and shortgrass communities in the Rolling Plains near Throckmorton, Texas. Measurements were made on 1 pasture of each treatment during 1977 following 4-20 yr of grazing treatments. Heavy, continuous cattle grazing had more area occupied by the shortgrass community than midgrass community. Heavily grazed pastures were generally dominated by the shortgrass community, with midgrasses depending on the degree of utilization, restricted to the shrub zonal community. Cattle enclosures had no shortgrass community, and deferred-rotation and moderately stocked continuously grazed systems had much midgrass community with the shortgrass community occupying only 30% of the area, thus increasing range productivity. Vegetation and soil parameters within the high intensity, low frequency and heavily stocked, continuously grazed pastures tended to be similar for the midgrass and shortgrass communities, but the shrub zonal community was generally different. Vegetation and soil parameters in the midgrass community of the moderately stocked, continuously grazed treatment were generally similar to shrub zonal and different from shortgrass communities. Vegetation and soil variables in the enclosures and deferred-rotation treatments were generally similar among the midgrass and shrub zonal communities; they differed from the shortgrass communities.

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1190. Vegetation change after 13 years of livestock grazing exclusion on sagebrush semi desert in west central Utah.

West, N. E.; Provenza, F. D.; Johnson, P. S.; and Owens, M. K.

Journal of Range Management 37(3): 262-264. (1984)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1984/373/18west.pdf>

Descriptors: Elytrigia intermedia/ Elytrigia smithii/ Elytrigia spicata/ Elymus hystrix/ Oryzopsis hymenoides/ Stipa comata/ Stipa lettermanii/ Poa secunda/ Bromus tectorum/ Artemisia tridentata ssp. tridentata/ forage production/ successional stability/ direction manipulation

Abstract: Range managers often assume that release of vegetation from livestock grazing pressure will automatically result in a trend toward the pristine condition. The pathways and time scales for recovery are also sometimes assumed to be the same as for retrogression. These assumptions were examined via monitoring of plant community composition and forage production in 5 large paddocks of sagebrush [*Artemisia tridentata* ssp. *tridentata*] semi-desert vegetation in west central Utah over a 13-year interval. No significant increases in native perennial grasses [*Elytrigia intermedia*, *E. smithii*, *E. spicata*, *Oryzopsis hymenoides*, *Stipa comata*, *S. lettermanii*, *Poa secunda*, *Bromus tectorum*] were noted over this period despite a trend toward more favorable precipitation in recent years. The present brush-dominated plant community is probably successional stable. A return to vegetation similar to the original sagebrush-native grass mixture is unlikely. The possibility of a successional deflection via fire is enhanced by the increase of annual grass. Improvement of forage production in this vegetation will not necessarily follow after livestock exclusion. Direction manipulations are mandatory if rapid returns to perennial grass dominants are desired in such environments.

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1191. Vegetation change after 65 years of grazing and grazing exclusion.

Courtois, D. R.; Perryman, B. L.; and Hussein, H. S.

Journal of Range Management 57(6): 574-582. (2004)

NAL Call #: 60.18 J82; ISSN: 0022-409X

Descriptors: rangelands/ grazing intensity/ semiarid zones/ plant communities/ botanical composition/ Nevada

Abstract: The Nevada Plots enclosure system was constructed in 1937 following passage of the Taylor Grazing Act to assess long-term effects of livestock grazing on Nevada rangelands. A comparison of vegetation characteristics inside and outside enclosures was conducted during 2001 and 2002 at 16 sites. Data analysis was performed with a paired t test. Out of 238 cover and density comparisons between inside and outside enclosures at each site, 34 (14% of total) were different ($P < 0.05$). Generally, where differences occurred, basal and canopy cover were greater inside enclosures and density was greater outside. Shrubs were taller inside enclosures at 3 sites grazed by sheep (*Ovis aries*). Perennial grasses showed no vertical height difference. Aboveground plant biomass production was different at only 1 site. Plant community diversity inside and outside enclosures were equal at 11 of 16 sites. Species richness was similar at all sites and never varied > 4 species at any site. Few changes in species composition, cover, density, and

production inside and outside enclosures have occurred in 65 years, indicating that recovery rates since pre-Taylor Grazing Act conditions were similar under moderate grazing and grazing exclusion on these enclosure sites. This citation is from AGRICOLA.

1192. Vegetation change following exclusion of grazing animals in depleted grassland, Central Otago, New Zealand.

Allen, R. B.; Wilson, J. Bastow; and Mason, C. R.

Journal of Vegetation Science 6(5): 615-626. (1995)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: ground cover/ mathematical model/ plant height/ pulse phase dynamic model/ rainfall

Abstract: Models of semi-arid vegetation dynamics were evaluated to explain changes in the grassland of interior South Island, New Zealand. Annual records were taken for six years of plant species height frequency and percentage ground cover in five plots established in 1986. One subplot at each site was fenced to exclude sheep, one to exclude rabbits and sheep, and one remained unfenced as a control. Records from 1986-1992 were analysed by ordination. The overall pattern of vegetation change shows considerable year-to-year variation. At some sites, variation in vegetation composition between years was as great as, or greater than, that between grazed and ungrazed subplots. Such variation is particularly evident in grazed vegetation, perhaps because it is under greater stress than ungrazed vegetation. At one site changes in vegetation total cover and species composition could be statistically related to rainfall during the first half of the growing season. The only general trends following cessation of grazing were for perennials to increase in frequency, and for year-to-year changes to become smaller with time. Total vegetation cover values seldom changed as a result of cessation of grazing, but tended to follow year-to-year changes in species frequency. The results do not in general support switch/state-and-transition models of semi-arid vegetation dynamics. Vegetation change follows changes in grazing and climate with little lag. This most closely conforms with the Pulse-phase dynamic model.

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1193. Vegetation change following removal of keystone herbivores from desert grasslands in New Mexico.

Ryerson, Daniel E. and Parmenter, Robert R.

Journal of Vegetation Science 12(2): 167-180. (2001)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: climatic conditions/ desert grasslands/ enclosure/ grazing/ keystone herbivore removal/ plant community response/ plant litter/ plant herbivore interaction/ site history/ vegetation change

Abstract: Responses of plant communities to mammalian herbivores vary widely, due to variation in plant species composition, herbivore densities, forage preferences, soils, and climate. In this study, we evaluated vegetation changes on 30 sites within and adjacent to the Sevilleta National Wildlife Refuge (SNWR) in central New Mexico, USA, over a 20-yr period following removal of the major herbivores (livestock and prairie dogs) in 1972-1975. The study sites were established in 1976, and were resampled in 1986 and 1996 using line transect methods. At the landscape scale, repeated measures ANOVA of percentage cover measurements showed no significant overall net changes in total perennial plant basal cover, either with or without

herbivores present; however, there was an overall increase in annual forbs and plant litter from 1976 to 1996. At the site scale, significant changes in species composition and dominance were observed both through time and across the SNWR boundary. Site histories varied widely, with sites dominated by *Bouteloua eriopoda* being the most dynamic and sites dominated by *Scleropogon brevifolius* being the most persistent. Species-specific changes also were observed across multiple sites: *B. eriopoda* cover increased while *Gutierrezia sarothrae* greatly decreased. The non-uniform, multi-directional changes of the sites' vegetation acted to prevent detection of overall changes in perennial vegetation at the landscape level. Some sites displayed significant changes after removal of herbivores, while others appeared to respond primarily to climate dynamics. Certain species that were not preferred by livestock or prairie dogs, showed overall declines during drought periods, while other preferred species exhibited widespread increases during wetter periods regardless of herbivore presence. Therefore, the vegetation dynamics cannot be attributed solely to removal of herbivores, and in some cases can be explained by short- and long-term fluctuations in climate. These results emphasize the variety of responses of sites with differences in vegetation to mammalian herbivores under otherwise similar climatic conditions, and illustrate the value of site- and landscape-scale approaches to understanding the impacts of plant-herbivore interactions.

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1194. Vegetation change in a man-made salt marsh affected by a reduction in both grazing and drainage.

Esselink, Peter; Fresco, Latzi F. M.; and Dijkema, Kees S. *Applied Vegetation Science* 5(1): 17-32. (2002)
NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: framework ordination: analytical method/ vegetation survey: survey method/ artificial drainage system/ drainage/ grazing/ habitats/ man made salt marsh/ permanent plots/ soil aeration/ soil salinity/ soil waterlogging/ species frequency/ species richness/ trampling/ vegetation change/ vegetation succession

Abstract: In order to restore natural salt marsh in a 460-ha nature reserve established in man-made salt marsh in the Dollard estuary, The Netherlands, the artificial drainage system was neglected and cattle grazing reduced. Vegetation changes were traced through two vegetation surveys and monitoring of permanent plots over 15 yr after the management had been changed. Enclosure experiments were started to distinguish grazing effects from effects of increased soil waterlogging caused by the neglect of the drainage system. Both vegetation surveys and permanent plots demonstrated a dichotomy in vegetation succession. The incidence of secondary pioneer vegetation dominated by *Salicornia* spp. and *Suaeda maritima* increased from 0 to 20%, whereas the late-successional (*Phragmites australis*) vegetation from 10 to 15%. Grazing intensity decreased towards the sea. The grazed area contracted landward, which allowed vegetation dominated by tall species to increase seaward. Grazing and increased waterlogging interacted in several ways. The impact of trampling increased, and in the intensively grazed parts soil salinity increased. This can probably be explained by low vegetation cover in spring. Framework Ordination, an indirect-gradient-analysis technique, was used to infer the importance of environmental factors in influencing changes

in species composition. Many changes were positively or negatively correlated with soil aeration and soil salinity, whereas elevation was of minor importance. Grazing accounted for only a few changes in species frequency. Changes in permanent plots were greater during the first than during the second half of the study period. In enclosures that were installed halfway through the study period, there was a relatively rapid recovery of previously dominant species that had decreased during the first half of the study period. Species richness per unit area in the reserve increased. At the seaward side of the marsh, the altered management allowed succession to proceed leading to establishment of stands of *Phragmites australis*, whereas on the landward side, the combination of moderate grazing with neglect of the drainage system appeared an effective measure in maintaining habitats for a wider range of halophytic species.

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1195. Vegetation change in an ombrotrophic mire in northern England after excluding sheep.

Smith, R. S.; Charman, D.; Rushton, S. P.; Sanderson, R. A.; Simkin, J. M.; and Shiel, R. S. *Applied Vegetation Science* 6(2): 261-270. (2003)
NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: grazing cessation/ ombrotrophic mire/ sheep exclusion impact/ site condition/ vegetation change

Abstract: The role of sheep grazing on vegetation change in upland mires removed from livestock farming and surrounded by conifer plantation was investigated with a grazing trial at Butterburn Flow in northern England. Paired grazed and ungrazed plots from central and peripheral locations were compared over 14 yr. Vegetation data from 34 mires in Kielder Forest provided an ordination framework within which vegetation trends were investigated. A gradient from dry moorland/hummock to wet mire/hollow vegetation dominated this framework and may reflect hydrological variability and structural vegetation differences between the mires. Some species were significantly affected by change in grazing intensity and there were differences between the edge and the centre of the mire. Overall vegetation change depended upon the grazing management and the position of the plots such that the removal of sheep grazing decreased the cover of species typical of wet ombrotrophic conditions, but only at the periphery of the mire. The vegetation in one plot became very similar to that of mires elsewhere in Kielder Forest where sheep were removed several decades ago. Cessation of grazing on upland mires is likely to lead to slow structural and species change in vegetation at the mire edge with a long-term loss of ombrotrophic species. The nature conservation significance of these changes will depend upon whether or not management objectives target natural conditions or wish to maximize ombrotrophic vegetation. The context of external factors such as climate and pollution may, however, be more important in determining site condition on the wettest mires.

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1196. Vegetation changes after 10 years of grazing exclusion and intermittent burning in a Themeda triandra (Poaceae) grassland reserve in south-eastern Australia.

Lunt, Ian D. and Morgan, John W.

Australian Journal of Botany 47(4): 537-552. (1999)

NAL Call #: 450 Au72; ISSN: 0067-1924

Descriptors: adaptive management: management method/ vegetation change: grazing exclusion, intermittent burning

Abstract: Changes in the vegetation composition of a remnant Themeda triandra Forsskal grassland in southeastern Australia were documented following the replacement of stock grazing with intermittent burning at 3-11-year intervals. The vegetation was initially sampled in 1986, 1 year after stock were removed, and then 10 years later in 1996. Most frequently encountered grassland species were abundant in both surveys, although there was little correspondence between species richness at the quadrat scale in 1986 and 1996. Total floristic richness increased slightly over the 10-year period, owing to the proliferation of tall forbs with wind-blown seeds, including exotic thistles and colonising native forbs. Unfortunately, most native 'increasers' were 'weedy' species which are not typical or common components of species-rich temperate grassland remnants in southern Victoria. Thus, replacing grazing with intermittent burning has not resulted in the flora becoming more similar to that of high-quality, species-rich grassland remnants, but instead, has promoted a group of ruderal colonisers. The ability to identify factors contributing to particular botanical changes was hampered by the design of the management regimes implemented over the past decade. Suggestions are provided to overcome these difficulties, incorporating principles from adaptive management.

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1197. Vegetation changes following sheep grazing in abandoned mountain meadows.

Krahulec, Frantisek; Skalova, Hana; Herben, Tomas; Hadincova, Vera; Wildova, Radka; and Pechackova, Sylvie
Applied Vegetation Science 4(1): 97-102. (2001)

NAL Call #: QK900 .A66; ISSN: 1402-2001

Descriptors: abandoned mountain meadows/ ecosystem restoration/ vegetation succession

Abstract: Sheep grazing was investigated as an alternative to traditional management of meadows in the Krkonose Mts. Until the second World War these meadows were mown in mid-summer and grazed by cattle for the rest of the season. Subsequent abandonment of the meadows has resulted in decreasing species richness. Degradation phases of the former communities have been replacing the original species-rich vegetation. Significant changes were apparent six years after the introduction of sheep grazing. In grazed plots the proportion of dominant herbs (*Polygonum bistorta* and *Hypericum maculatum*) decreased and grasses (*Deschampsia cespitosa*, *Festuca rubra*, *Agrostis capillaris*, *Anthoxanthum alpinum*) increased. The increase in grasses was positively correlated with an increase in several herbs. The proportion of some herbs increased despite being selectively grazed (*Adenostyles alliariae*, *Melandrium rubrum*, *Veratrum lobelianum*). Any losses caused by grazing of mature plants were probably compensated by successful seedling establishment. Cessation of grazing resulted in significant changes in vegetation within three years. The cover of nitrophilous tall

herbs and grasses (e.g. *Rumex alpestris*, *Holcus mollis*, *Deschampsia cespitosa*, *Geranium sylvaticum*) increased in the abandoned plots. In the plots grazed for nine years cover of species-rich mountain meadow species increased (e.g. fine-leaved grasses, *Campanula bohemica*, *Potentilla aurea*, *Viola lutea*, *Silene vulgaris*). The main conservation risk is the expansion of a competitive species with low palatability, *Deschampsia cespitosa*. This species can be suppressed by a combination of grazing and mowing. In order for grazing to be effective, the number of sheep should be proportional to meadow production. This may be difficult to maintain as production is variable and is impossible to predict at the beginning of a growing season. A large part of the biomass may thus remain intact in some years. Negative effects of grazing may be, at least partly, eliminated by a combination of cutting and grazing.

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1198. Vegetation changes in relation to livestock exclusion and rootplowing in southeastern Arizona.

Roundy, B. A. and Jordan, G. L.

Southwestern Naturalist 33(4): 425-436. (1988)

NAL Call #: 409.6 SO8; ISSN: 0038-4909

Descriptors: grasslands/ livestock/ roots/ plowing/ deserts/ plant density/ ecological succession/ grazing/ Arizona

This citation is from AGRICOLA.

1199. Vegetation development after the exclusion of grazing cattle in meadow area in the south of Sweden.

Persson, S.

Vegetatio 55(2): 65-92. (1984)

NAL Call #: 450 V52; ISSN: 0042-3106

Descriptors: succession/ environmental gradients/ moisture/ management history

Abstract: A 24 yr study of secondary succession was based on data from semi-permanent quadrats from investigations in 1952, 1955, 1968 and 1976, involving 2 exclosures, the first in a meadow grazed for hundreds of years but now abandoned, the second in a meadow mowed for hundreds of years and grazed for the last 50 yr. A 1st order classification of quadrats produced units, which formed distinct spatial patterns indicating similar gradients, but also differences in response to the ceased grazing, in the 2 exclosures. A 2nd order classification of units into groups revealed a rather simple structure of spatial and temporal relations. Eleven groups of species with similar behavior could be recognized within a system of spatial and temporal species distributions. The vegetation in both exclosures developed towards an increased differentiation and heterogeneity or patchiness. The border between 2 soil types was clearly reflected in the spatial pattern of units. Rates of change were greatest in the beginning and were shown to closely follow logarithmic functions of time. The average number of species per m² decreased in all plots, in some cases as much as 50%. The diversity decreased as a consequence of decreased species richness, decreased evenness and decreased pattern diversity. Many individual species distributions showed a pattern of nuclei surrounded with marginal belts. Differences in rate of change and persistence of spatial patterns between the plots could be attributed to the differences in management history. These differences disappeared as the succession proceeded. The 2 exclosures instead both conformed to the same floristic gradient, in turn based on a similar pattern of environmental gradients, primarily moisture. In the observed changes the

emphasis was on the shifting importance of competing species populations, as some gained in importance at the expense of others. Competition has so far been a more important process in the vegetation development than immigration/extinction rates.

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1200. Vegetation development influenced by grazing in the coastal dunes near The Hague, The Netherlands.

De Bonte, A. J.; Boosten, A.; Van Der Hagen, Hgjm; and Sykora, K. V.

Journal of Coastal Conservation 5(1): 59-68. (1999)

NAL Call #: GC1080; ISSN: 1400-0350

Descriptors: detrended correspondence analysis: statistical method/ twinspan: classification method/ coastal sand dune system/ grazing/ nature management/ vegetation development

Abstract: In 1990, grazing was introduced in a section of Meijendel, a coastal sand dune system near The Hague, The Netherlands. After five years an evaluation was made of the effects of grazing on vegetation development. Three transects were established, two in grazed areas and one in an ungrazed area. Field survey data were classified by means of TWINSpan, ordinated with Detrended Correspondence Analysis and the resulting vegetation types interpreted according to Westhoff and den Held (1969). All associations were found in both the grazed and the ungrazed areas, but at the subassociation and variant level some communities appeared to be restricted to the grazed area. These variants were five grassland variants characterized by disturbance indicators such as *Senecio sylvaticus* and *Cynoglossum officinale*. The total number of plant species in the 19 permanent plots, which had been observed to have been decreasing since 1960, showed a considerable increase after the introduction of horses and cows in 1990. A marked decrease in the cover of *Calamagrostis epigejos* and *Carex arenaria* since 1990 was evident, while in some plots species such as *Ribes rubrum* and *Viburnum opulus* increased considerably. A series of false-colour aerial photographs were used to compare vegetation structure in the three transects between 1990 and 1995. In the grazed area the tall grass vegetation had almost totally disappeared, whereas the areas of open sand, sand with moss and lichens, and low grass vegetation had increased and the pattern had become more fine-grained. In the ungrazed area the area covered by low grass vegetation had increased at the expense of the area of sand with moss and lichens and the pattern had become more coarse-grained.

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1201. Vegetation development over 25 years without grazing on sagebrush-dominated rangeland in southeastern Idaho.

Anderson, J. E. and Holte, K. E.

Journal of Range Management 34(1): 25-29. (1981)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1981/341/7ande.pdf>

Descriptors: Idaho

This citation is from AGRICOLA.

1202. Vegetation dynamics and plant species interactions under grazed and ungrazed conditions in a western European salt marsh.

Tessier, M.; Vivier, J. P.; Ouin, A.; Gloaguen, J. C.; and Lefeuvre, J. C.

Acta Oecologica 24(2): 103-111. (2003)

NAL Call #: QH540.A27; ISSN: 1146-609X

Descriptors: salt marshes/ vegetation/ grazing/ species diversity/ plant populations/ vegetation cover/ population structure/ biomass/ dominant species/ ecological succession/ fertilizers/ nitrogen/ enclosures/ Suaeda maritima/ Puccinellia maritima/ Salicornia europaea/ Halimione portulacoides/ France/ halophytes

Abstract: Experiments in enclosures were conducted on a salt marsh in a macrotidal system in western France. The aim of this study was threefold: (1) to compare vegetation dynamics over a period of 8 years in grazed and ungrazed conditions (2) to investigate the response of annual species to grazing duration during seedling establishment (3) to test the effect of an increase in soil nitrogen availability after cessation of grazing on interactions between *Suaeda maritima* and *Puccinellia maritima*. In grazed conditions, during all the survey, vegetation was dominated by a short *P. maritima* sward with the annual *Salicornia europaea* in the lower and middle marshes. However, after cessation of grazing in 1994, a homogeneous matrix of the forb *Halimione portulacoides*, quickly replaced *P. maritima* in the well drained lower marsh. At the middle marsh level, fine sediment and poor drainage maintained *P. maritima* while the annual *S. maritima* which tolerates taller and denser vegetation replaced *S. europaea*. *Elymus pungens* cover was limited till 2000 but its rising in 2001 let expect its dominance in the future. While *P. maritima* abundance remained high, spring abundance of annual species such as *S. europaea* and *S. maritima* globally decreased with sheep grazing duration on the salt marsh between February and June. Experiments with monocultures of *P. maritima* and *S. maritima* demonstrated that nitrogen was a limiting factor on the salt marsh. In a mixed community, a moderate application of nitrogen (15 g N m⁻² year⁻¹) as NH₄⁺-NO₃⁻ promoted growth of *P. maritima* and limited the biomass of *S. maritima*, but growth of the latter was enhanced by a high application of nitrogen (30 g N m⁻² year⁻¹). An increase in the abundance of annuals such as *S. maritima* on the salt marsh is discussed.

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1203. Vegetation of exclosures in southwestern North Dakota.

Brand, M. D. and Goetz, H.

Journal of Range Management 39(5): 434-437. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/395/14bran.pdf>

Descriptors: grasslands/ botanical composition/ ecological succession/ range management/ North Dakota

This citation is from AGRICOLA.

1204. Vegetation response on allotments grazed under rest-rotation management.

Eckert, R. H. and Spencer, J. S.

Journal of Range Management 39(2): 166-174. (1986)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1986/392/18ecke.pdf>

Descriptors: range management/ plant communities/ ecological succession/ rotational grazing/ botanical composition/ vegetation/ grazing/ rangelands/ Nevada
This citation is from AGRICOLA.

1205. Vegetation response to cattail management at Cheyenne Bottoms, Kansas.

Kostecke, R. M.; Smith, L. M.; and Hands, H. M.

Journal of Aquatic Plant Management 42(1): 39-45. (2004)

NAL Call #: SB614.H9; ISSN: 0146-6623

Descriptors: plant control/ wetlands/ fire/ grazing/ population density/ aquatic plants/ species diversity/ habitat improvement (biological)/ aquatic birds/ vegetation cover/ plant populations/ ecosystem management/ environment management/ migratory species/ cattails/ incineration/ wildlife/ density/ vegetation/ biomass/ birds/ habitats/ Typha/ Aves/ USA, Kansas/ birds/ Cheyenne Bottoms Wildlife Area

Abstract: Dense, monospecific cattail (*Typha* spp.) stands are a problem in many prairie wetlands because they alter habitat structure and function, resulting in a decrease in use by wildlife species. Cheyenne Bottoms Wildlife Area, a Wetland of International Importance in central Kansas, has experienced a large increase in cattails and a subsequent decrease in migratory wetland bird use. As a consequence, intensive cattail management is practiced. We assessed the effectiveness of prescribed burning, discing following prescribed burning, and cattle grazing following prescribed burning at two stocking rates of 5 and 20 head per 11 ha in suppressing cattail, as well as the effects of these treatments on non-cattail vegetation. The disced and high-intensity (20 head per 11 ha) grazed treatments resulted in the lowest cattail densities and biomass. Implementation of these treatments, however, was at the expense of the non-cattail aquatic plant community. Species richness and diversity, and non-cattail shoot density and biomass, were generally lowest in these treatments. In managed wetlands where cattail reduction is the objective, we recommend discing or high-intensity grazing following prescribed burning to improve wildlife use, at least in the short-term, as they suppressed cattail more effectively than burning alone or low-intensity (5 head per 11 ha) grazing.

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1206. Vegetation response to cattle grazing in the Ethiopian highlands.

Mwendera, E. J.; Saleem, M. A. M.; and Woldu, Z.

Agriculture, Ecosystems & Environment 64(1):

43-51. (1997)

NAL Call #: S601 .A34; ISSN: 0167-8809

Descriptors: biomass yield/ botanical composition/ cattle grazing/ net primary production/ species richness/ vegetation cover

Abstract: The effect of grazing cattle on vegetation was studied on a natural pasture during the rainy and dry seasons of 1995 in the Ethiopian highlands. The study used 0.01 ha plots, established on 0-4% and 4-8% slopes located close to each other at Debre Zeit research station, 50 km South of Addis Ababa. The grazing regimes were:

light grazing stocked at 0.6 animal-unit-month per hectare (AUM ha⁻¹); moderate grazing stocked at 1.8 AUM ha⁻¹; heavy grazing stocked at 3.0 AUM ha⁻¹; very heavy grazing stocked at 4.2 AUM ha⁻¹; very heavy grazing on ploughed pasture stocked at 4.2 AUM ha⁻¹; and a control of 'no grazing'. Heavy grazing significantly reduced vegetative cover and biomass yields, especially on steeper slopes. Light to heavy grazing did not affect the botanical composition of the vegetation at both sites, but very heavy grazing resulted in species normally less preferred by animals dominating the botanical composition. Grazing did not have significant effect on ground vegetative cover on the 0-4% slope except at very heavy grazing pressure, but on the 4-8% slope even moderate grazing significantly reduced vegetative cover. Light to moderate grazing at the beginning of the dry period enhanced plant biomass productivity, while any grazing reduced plant productivity during the periods of reduced growth. Species richness increased with increasing grazing pressure compared with no grazing, but decreased sharply at very heavy grazing pressure. We concluded that there is need for developing 'slope and time specific' grazing management practices, and to assess short and long term effects of grazing and trampling on vegetation.

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1207. Vegetation response to continuous versus short duration grazing on sandy rangeland.

Dahl, B. E.; Cotter, P. F.; Dickerson, R. L.; and

Mosley, J. C.

Texas Journal of Agriculture and Natural Resources 5: 73-81. (1992)

NAL Call #: S1.T49; ISSN: 0891-5466

Descriptors: beef cattle/ steers/ pasture plants/ pastures/ stocking rate/ botanical composition/ forage/ yields/ range management/ climatic factors/ sandy soils/ Texas
This citation is from AGRICOLA.

1208. Vegetation response to grazing management in a Mediterranean herbaceous community: A functional group approach.

Sternberg, Marcelo; Gutman, Mario; Perevolotsky, Avi; Ungar, Eugene D.; and Kigel, Jaime

Journal of Applied Ecology 37(2): 224-237. (2000)

NAL Call #: 410 J828; ISSN: 0021-8901

Descriptors: mediterranean herbaceous community/ climatic conditions/ community composition/ community structure/ functional types/ grazing effects/ grazing management/ grazing regime/ inter seasonal rainfall variation/ plant cover/ species richness/ vegetation response

Abstract: 1. A 4-year study was conducted in a Mediterranean herbaceous community in north-eastern Israel to investigate the effects of cattle grazing management on the structure and composition of the community. Understanding the effects of grazing on the dynamics of Mediterranean herbaceous communities is important in formulating rational management plans for both conservation and sustainable animal production. 2. The relationships among plant functional groups were studied in the context of inter-annual variation in rainfall. Treatments included manipulations of stocking rates (moderate, heavy and very heavy) and grazing regimes (continuous vs. seasonal), in a factorial design. 3. The herbaceous community was rich in species, with 166 species recorded

at the site, of which 74% were annuals. Plant cover was dominated by 10 species that accounted for 75% of the total cover. 4. Inter-seasonal rainfall variation was a dominant factor in the expression of different grazing treatments on the structure of the plant community. Grazing effects were stronger in wet years than in dry years. 5. Paddocks under continuous grazing were higher in number of species compared with paddocks subjected to seasonal grazing, independently of grazing intensity. 6. Functional group analyses showed that reduction in cover of tall grasses was correlated with an increase in cover of prostrate annual legumes and less palatable groups such as annual and perennial thistles, crucifers and forbs. 7. Cover of functional groups composed of hemicryptophytic species was less variable (lower coefficient of variation) in response to grazing treatments and inter-annual variation in climatic conditions compared with functional groups with annual species. 8. The persistence of the dominant species and the relatively small amplitude of change in plant cover of the functional groups suggest that the community was rather stable in spite of wide variation in grazing regimes and climatic conditions. East-Mediterranean grasslands appear to be adapted to grazing due to their long history of human association.

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1209. Vegetation response to increased stocking rates in short-duration grazing.

Ralphs, M. H.; Kothmann, M. M.; and Taylor, C. A. *Journal of Range Management* 43(2): 104-108. (1990)
NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/432/5ralp.pdf>

Descriptors: cattle/ stocking rate/ grazing/ plant density/ botanical composition/ pastures/ forage/ Texas

Abstract: Short-duration grazing (SDG) has been purported to increase forage production and utilization compared to other grazing systems, and thus can sustain higher stocking rates. This study was designed to determine if standing crop could be maintained as stocking rates increased. Four stocking rate treatments ranging from the recommended rate for moderate continuous grazing to 2.5 times the recommended rate were applied in a simulated 8-pasture SDG system. There was little change in frequency and composition of short-grasses over the study, but mid-grass frequency and composition both declined. Standing crop of all major forage classes declined as stocking rates increased. However, the rate of decline was less than proportional to the increase in stocking rate during the growing season. By fall, standing crop was inversely proportional to stocking rate, leading us to conclude that standing crop could not be maintained at the higher stocking rates. Low standing crop in the fall indicated a potential shortage of forage at the high stocking rates during the winter.

This citation is from AGRICOLA.

1210. Vegetation response to increasing stocking rate under rotational stocking.

Taylor, C. A.; Ralphs, M. H.; and Kothmann, M. M. *Journal of Range Management* 50(4): 439-442. (1997)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/1997/504/439-443_taylor.pdf

Descriptors: botanical composition/ rotational grazing/ stocking rate/ vegetation/ grazing/ overgrazing/ grazing systems/ grazing intensity/ grasslands/ rangelands/ palatability/ *Digitaria cognata*/ *Bothriochloa edwardsiana*/ *Panicum obtusum*

Abstract: A 10-year study was designed to evaluate vegetation response to increasing stocking rates under rotational stocking (3 days grazing, 51 days resting) and long-term resting. The 4 stocking rate treatments ranged from the recommended rate for moderate continuous grazing to 2.7-fold the recommended rate. Common curly-mesquite [*Hilaria belangeri*] increased in all grazed treatments and decreased in the livestock enclosure. Sideoats grama (*Bouteloua curtipendula*) along with other midgrasses (*Digitaria cognata*, *Bothriochloa edwardsiana*, *Panicum obtusum* and *Bothriochloa ischaemum*) decreased in all grazed treatments and increased in the livestock enclosure. Because the midgrasses were palatable species and not abundant, they were grazed too intensively and too frequently. Rotational stocking was not able to sustain initial species composition at any of the stocking rates tested.

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1211. Vegetation response to stocking rate in southern mixed-grass prairie.

Gillen, R. L.; Eckroat, J. A.; and McCollum, F. T. *Journal of Range Management* 53(5): 471-478. (2000)
NAL Call #: 60.18 J82; ISSN: 0022-409X
http://jrm.library.arizona.edu/data/2000/535/471-478_gillen.pdf

Descriptors: beef cattle/ stocking rate/ biomass/ botanical composition/ *Bouteloua curtipendula*/ forbs/ *Aristida purpurea* var. *longisetata*/ *Aristida purpurea*/ rain/ *Bothriochloa*/ grasses/ ecological succession/ Oklahoma

Abstract: Stocking rate directly influences the frequency and intensity of defoliation of individual plants which, in turn, impacts energy flow and plant succession in grazed ecosystems. The objective of this study was to determine the effect of stocking rate on standing crop dynamics and plant species composition of a southern mixed-grass prairie over a 7-year period (1990 through 1996). Long-term (30-year) mean precipitation has been 766 mm per year. Growing conditions were generally favorable for the study period. Yearling cattle (initial weight 216 kg, SD = 12 kg) grazed at 6 stocking rates, ranging from 23 to 51 AUD ha⁻¹, from 14 April to 24 September (162 days). The currently suggested year-long stocking rate is 25 AUD ha⁻¹. Herbage standing crop was measured in July and September every year while species composition was determined in July in even years. Total and dead standing crop declined as stocking rate increased but live standing crop was not related to stocking rate. Slopes of regression lines relating standing crop and stocking rate were constant over years, indicating no response for plant productivity. The major vegetation components, sideoats grama [*Bouteloua curtipendula* (Mich.) Torr.], shortgrasses, and forbs were not affected by stocking rate over years. Tallgrasses responded by increasing at the lower stocking rates over the study period. However, these grasses contributed less than 5% of the total standing crop. Red and purple threeawn (*Aristida longisetata* Steud. and *A. purpurea* Nutt.) increased at all stocking rates from 1990 to 1996 but the increase was greater at the lower stocking rates. This mixed-grass vegetation showed little response to stocking rate over the 7-year study period. The vegetation may have

been in equilibrium with previous heavy stocking rates so that little change would be expected at those rates. Increases in grazing sensitive species at lighter stocking rates may occur over longer time intervals. This citation is from AGRICOLA.

1212. Vegetation response to the Santa Rita grazing system.

Martin, S. C. and Severson, K. E.
Journal of Range Management 41(4): 291-295. (1988)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1988/414/5mart.pdf>
Descriptors: semidesert grassland/ grass density/ USA/ rotation grazing/ shrub intercept
Abstract: Changes in vegetation under yearlong grazing were compared with those under the Santa Rita grazing system, a rotation system designed for southwestern US rangelands where 90% of the forage is produced in mid- to late-summer. The study was conducted on the Santa Rita Experimental Range near Tucson, Arizona [USA] from 1972 to 1984. In 1984 there were no differences ($P < 0.05$) in grass densities (16 vs. 17 to 18 plants/m²), forb densities (0.6 vs 0.7 to 1.4 plants/m²), or shrub densities (2.0 vs 1.9 to 2.4 plants/m²), or shrub cover (20 vs 21 to 26%) on pastures grazed yearlong or in the Santa Rita rotation, respectively. Lack of response to grazing schedules is attributed to initial plant densities near the maximum the sites could support and to moderate grazing during the study period. Average herbage yields of pastures were not related significantly to grazing treatments but correlated strongly ($r = 0.909$) with long-time summer rainfall means. Results support the observation that rotation grazing may not improve ranges that are in good condition. It is concluded, however, that the Santa Rita Grazing System may accelerate recovery of ranges in poor condition.
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1213. Vegetation response to time-controlled grazing on mixed and fescue prairie.

Willms, W. D.; Smoliak, S.; and Dormaar, J. F.
Journal of Range Management 43(6): 513-517. (1990)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1990/436/8will.pdf>
Descriptors: cattle/ stocking rate/ prairies/ Festuca/ botanical composition/ regrowth/ crop yield/ forage/ root systems/ grazing/ Alberta
 This citation is from AGRICOLA.

1214. Vegetation responses to long-term sheep grazing on mountain ranges.

Bowns, J. E. and Bagley, C. F.
Journal of Range Management 39(5): 431-434. (1986)
 NAL Call #: 60.18 J82; ISSN: 0022-409X
<http://jrm.library.arizona.edu/data/1986/395/13bown.pdf>
Descriptors: sheep/ vegetation/ long term experiments/ grazing/ Utah
 This citation is from AGRICOLA.

1215. Vegetation restoration by seasonal enclosure in the Kerqin Sandy Land, Inner Mongolia.

Katoh, Kazuhiro; Takeuchi, Kazuhiko; Jiang, Deming; Nan, Yin hao; and Kou, Zhenwu
Plant Ecology 139(2): 133-144. (1998)
 NAL Call #: QK900.P63; ISSN: 1385-0237

Descriptors: desertification/ grazing control/ seasonal enclosure/ species composition/ vegetation restoration
Abstract: Grazing control has been reported to be effective for the control of desertification in semi-arid regions. However, economic reasons often make complete inhibition of grazing (complete enclosure) difficult to carry out. Grazing control has been applied to the Kerqin Sandy Lands, Inner Mongolia, China, by means of seasonal enclosure, whereby grazing is allowed from November to April. The harvesting of hay is also allowed once during September - October. The aim of the reported study was to evaluate the effectiveness of this seasonal enclosure on vegetation restoration. Species compositional data were obtained from 356 quadrats and ordinated by Detrended Correspondence Analysis (DCA). Ordination indicated that landform was the most important factor influencing the species composition of the vegetation. Regardless of landform and type of grazing control, however, vegetation coverage, vegetation height and species richness were higher at sites where grazing had been controlled, than at sites lacking any control. Perennial species were dominant at the former while annual species were dominant at the latter. Both shrub and tree species were quite rare at the sites where seasonal enclosure had been carried out. It is concluded that seasonal enclosure is sufficient to restore and maintain grassland vegetation in and around the study area. When shrubby or tree vegetation is needed for reasons such as fixing sands or preventing sand dune remobilization, complete enclosure is recommended.
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1216. Vegetation, soil hydrophysical properties, and grazing relationships in saline-sodic soils of central Argentina.

Cisneros, J. M.; Cantero, J. J.; and Cantero, A.
Canadian Journal of Soil Science 79(3): 399-409. (1999)
 NAL Call #: 56.8 C162; ISSN: 0008-4271
Descriptors: drainage/ enclosure/ grazing relationships/ infiltration/ runoff/ saline sodic soil/ soil hydrophysical properties/ vegetation
Abstract: Land use and grazing regime can influence the dynamic of soil water and salt in humid areas. In Central Argentina, more than 2 X 10⁶ ha are subjected to either permanent or cyclical processes of land salinization, alkalization, flooding and sedimentation. In this region, the natural vegetation is the principal resource on which most systems of animal production are based. The objective of this study was to evaluate the effects of plant cover and grazing over some hydrophysical properties of three saline-sodic soils (two Gleic Solonetz in duripan phase and one Mollic Solonetz in fragipan phase), within a catena sequence. The effects on bulk density, saturated hydraulic conductivity, infiltration runoff, superficial salt accumulation and soil salinity distribution were determined in both bare and covered soil conditions, inside and outside of grazing enclosures. The results showed increased bulk density of topsoil for bare conditions, while saturated hydraulic conductivity did not show significant differences. In soils without any cover, the infiltration decreased significantly. Consequently, the runoff coefficient and salinity were greater, as indicated by significant salt accumulation in the topsoil. The soil profile salinity was reduced as a function of enclosure time, showing a trend toward desalinization resulting from a combined effect of soil cover and changes in intensity of land use. A conceptual model of salt and

water dynamics in the soil profile for the landscape scale is postulated. The role of vegetation in regulating water and salt movement in poorly drained areas is emphasised as a basis for the development of management strategies.

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1217. Vegetation trends within rest-rotation and season-long grazing systems in the Missouri River breaks.

Watts, C. R.; Eichhorn, L. C.; and Mackie, R. J.
Journal of Range Management 40(5): 393-396. (1987)
NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1987/405/3watt.pdf>

Descriptors: cattle/ canopy coverage/ exclosures/ soil cover

Abstract: Trends in canopy-coverage of vegetation and bare ground were measured inside and outside exclosures on recent burns within three-pasture rest-rotation and season-long grazing systems over a 10-year period.

Results suggested that rest-rotation grazing may maintain vegetation and soil cover somewhat comparable to ungrazed cattle exclosures on rough breaks-type range in north-central Montana. Season-long grazing may not maintain satisfactory vegetation and soil cover in the area.

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1218. Vegetational response to short-duration and continuous grazing in southcentral New Mexico.

White, M. R.; Pieper, R. D.; Donart, G. B.; and Trifaro, L. W.
Journal of Range Management 44(4): 399-403. (1991)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/444/20whit.pdf>

Descriptors: Bouteloua gracilis/ vegetation/ cattle/ grazing intensity/ biomass/ botanical composition/ stocking rate/ pastures/ range management/ grazing/ vegetation cover/ New Mexico

Abstract: Vegetational response of a nine-paddock, short-duration grazing cell was compared to that of a continuous pasture for a 5-year period in southcentral New Mexico. Differences in vegetational response to short-duration and continuous grazing on blue grama rangeland were small. Basal plant cover was slightly higher for the short-duration pastures, but end-of-season standing crop of all species was similar for both systems. Blue grama aboveground productivity and basal cover were higher for the short-duration pastures than for the continuously-grazed pasture. Possible short-term results from short-duration grazing include slightly higher stocking rates and a positive response of blue grama.

This citation is from AGRICOLA.

1219. Vertical distribution of below-ground biomass in intensively grazed mesic grasslands.

Rodriguez, M. A.; Alvarez, J.; and Gomez Sal, A.
Journal of Vegetation Science 7(1): 137-142. (1996)

NAL Call #: QK900.J67; ISSN: 1100-9233

Descriptors: species diversity/ grassland management/ biomass/ altitude/ grasslands/ mountain grasslands/ Mediterranean grasslands/ grazing/ grazing intensity/ botanical composition/ roots/ distribution

Abstract: Eight grasslands at 4 grassland sites distributed along an altitudinal gradient were investigated in the Cantabrian Mountains, NW Spain during 1988, the upper and lower zones of a slope being sampled at each site. Four of these grasslands were grazed by livestock and the

other 4 were grazed and mown. Biomass was assessed in above-ground, root crown and 3 root layers. Species composition varied according to management and topography. Annuals and perennial forbs had relatively more above-ground biomass at the upper part of the slopes, while perennial grasses dominated the lower parts. The above-ground biomass and root biomass at 4-7 cm depth attained maximum values in the lower, potentially more fertile, parts of the slopes, while crown biomass increased with altitude. Despite their differences in composition and structure, 7 stands showed a remarkable concentration of below-ground biomass near the soil surface which decreased drastically with soil depth. This similarity was more evident in the more mesic-like grasslands, since it increased from the upper (potentially drier) parts of the slopes, to the lower parts, and, when each topographic position was considered separately, from low to high altitudes.

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1220. Wild ungulate influences on the recovery of willows, black cottonwood and thin-leaf alder following cessation of cattle grazing in northeastern Oregon.

Case, Richard L. and Kauffman, J. Boone
Northwest Science 71(2): 115-126. (1997)

NAL Call #: 470 N81; ISSN: 0029-344X

Descriptors: biomass/ black cottonwood/ conservation/ crown volume/ ecosystem restoration/ grazer/ grazing/ habitat degradation/ herbivore/ northeastern region/ salmonid habitat recovery/ seedling establishment/ thin leaf alder/ tree recovery

Abstract: Restoration of degraded riparian ecosystems is of great importance for the recovery of declining and endangered stocks of Columbia River salmonids as well as riparian-obligate wildlife species. Willows (*Salix* spp.), thin-leaf alder (*Alnus incana*), and black cottonwood (*Populus trichocarpa*) are important features of western riparian ecosystems having multiple functional roles that influence biological diversity, water quality/quantity, and aquatic/terrestrial food webs and habitats. Removal of domestic livestock and the construction of big game enclosures have been hypothesized to be effective restoration techniques for riparian ecosystem as well as for salmonid habitat recovery. Following more than a century of livestock grazing, cattle were removed from Meadow Creek in 1991 and the rates of riparian shrub recovery were measured for the two years following. Elk and deerproof enclosures were constructed to quantify the browsing influences of native large ungulates. The initial mean height of 515 deciduous trees and shrubs (14 species) was 47 cm. After two years in the absence of livestock, significant increases in height, crown area, crown volume, stem diameter and biomass were measured both outside and inside of the enclosures. Mean crown volume of willows increased 550% inside of wild ungulate exclosures and 195% outside. Black cottonwood increased 773% inside and 808% outside, while thin-leaf alder increased 1046% inside and 198% outside. Initial shrub densities on gravel bars were low averaging 10.7 woody plants/100m². Shrub numbers significantly increased approx 50% (to 15.8 plants/100m² m or one new shrub for every 9 meters of transect length) outside of elk and deer proof enclosures through both clonal and seedling establishment. At the beginning of the study (1991), catkin production on willows was low (i.e., only 10% produced catkins). Wild herbivores

had a significant influence on the reproductive output of willows; in 1993 catkins were produced by 34% of the tagged willows within enclosures but only 2% outside of enclosures. Wild herbivores were found to have significant influences on the rate of height growth of black cottonwood. For willows, wild herbivores had a significant influence on the rate of growth for the parameters of height, crown area, crown volume, and standing biomass. Nevertheless, due to the inherent resilience and adaptations to natural disturbance processes displayed by the riparian species, there was a rapid and positive response to cessation of those land use activities (i.e., cattle grazing) that caused habitat degradation and/or were preventing recovery.

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1221. Wildfire effects and post-fire responses of an invasive mesquite population: The interactive importance of grazing and non-native herbaceous species invasion.

Kupfer, John A. and Miller, Jay D.

Journal of Biogeography 32(3): 453-466. (2005)

NAL Call #: QH1.J62; ISSN: 0305-0270

Descriptors: Chihuahuan semi desert grassland/ madrean evergreen woodland/ grazing/ savanna/ wildfire

Abstract: Aim To determine how responses of an established velvet mesquite (*Prosopis velutina* Woot.) population to a 2002 wildfire were shaped by grazing and non-native herbaceous species invasions, both of which influenced fire behaviour. Location The study was conducted on contiguous ranches (one actively grazed by cattle, one that had not been grazed since 1968) in the Sonoita Valley of southern Arizona. Plant communities on both ranches were comprised of Chihuahuan semi-desert grassland, savanna, and Madrean evergreen woodland ecosystems, but large areas were dominated by Lehmann and Boer lovegrass, African grass species that were introduced more than 50 years ago. Methods We selected 243 individuals that had been defoliated and bark scorched during the fire using a stratified random design based on pre-fire grazing status and dominant grass cover. After the start of the 2003 growing season, we recorded individual tree characteristics, fire damage, and measures of post-fire response, and tested for relationships among classes of: grazing status, bark damage, dominant grass cover type, abundance of live and dead aboveground branches, flowering status, and sprout number and size. Analyses of fire damage and post-fire response were interpreted with respect to values of fireline intensity, scorch height and energy release that were projected by a fire behaviour model, nexus. Results Nearly all of the trees on grazed areas suffered low levels of fire damage, while a majority on ungrazed areas suffered moderate to severe damage. Trees on grazed areas consequently had significantly more leaf-bearing twigs and branches in 2003 but a very low number of root sprouts, while individuals on ungrazed areas had a greater density of root sprouts but little post-fire dead branching and almost no living branches. Among the ungrazed grassland types, more than 75% of the trees on Boer lovegrass plots suffered moderate to severe damage, while a similar percentage of trees in native grass areas suffered low damage. These differences were: (1) attributed to variations in fire characteristics that were caused by differences in litter production and removal, and (2) ecologically significant because trees in the severe damage class showed almost no aboveground post-fire branching,

either live or dead in 2003, while trees in the low damage class exhibited a greater amount of both. Main conclusions Our results affirm the notion that effective management of western grasslands where mesquite encroachment has or will become a problem requires a better understanding of how interactions among key ecosystem influences (e.g. fire, grazing, non-native species) affect not only mesquite seedlings and saplings but also larger, established individuals and thereby the long-term structure and functioning of semi-desert grassland ecosystems. As managers shift their focus from eradication to management of mesquite in western grasslands and savannas, our results provide insights into how prescribed fires (and their effects on mesquite populations) differ from wildfires and how such effects may be mediated by the altered land uses and ecosystem characteristics that now exist in many western ecosystems.

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1222. Willow planting success as influenced by site factors and cattle grazing in northeastern California.

Conroy, S. D. and Svejcar, T. J.

Journal of Range Management 44(1): 59-63. (1991)

NAL Call #: 60.18 J82; ISSN: 0022-409X

<http://jrm.library.arizona.edu/data/1991/441/13conr.pdf>

Descriptors: cattle/ Salix/ grazing intensity/ mortality/ plant communities/ soil water content/ water table/ riparian buffers/ grazing/ California

This citation is from AGRICOLA.

